CO-CONSTRUCTION, INFRASTRUCTURE, AND PURPOSE: INFLUENCES ON IMPLEMENTATION OF HUB-OUTLET SCHOOL REFORM

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ABSTRACT

CO-CONSTRUCTION, INFRASTRUCTURE, AND PURPOSE: INFLUENCES ON IMPLEMENTATION OF HUB-OUTLET SCHOOL REFORM

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This dissertation is a collection of three interrelated chapters that explore unique dimensions of hub-outlet school reform. This type of school reform, in which a central hub organization designs a model for instructional improvement meant to be implemented with fidelity across unique outlet school sites, has gained credibility in the crowded school reform marketplace as a way to improve instruction and, in turn, student achievement. These chapters describe a study of the implementation of one such school reform organization, the New Tech Network, and its work in three outlet high schools in Michigan. In particular, the chapters use different dimensions of an organizational analytical framework to understand variations in the ways New Tech's model for school reform is interpreted, supported, and applied in practice.

Chapter 1 explores how New Tech's model for reform was interpreted through an interactive sensemaking process among hub and outlet actors, in which unique interpretations were then co-constructed in different ways across classrooms and schools. Chapter 2 investigates New Tech's supports for developing educational infrastructure and how those supports varied. Finally, Chapter 3 documents the extent to which practice changed in the first two years of implementation, analyzing influences on variation among the hub, model, and outlets. Taken together, these chapters begin to unravel the complexities of implementing hub-outlet school reform and provide important evidence that characteristics of hubs and outlets can heavily influence the likelihood of high fidelity implementation.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

How to improve teaching and learning has, in recent years, shifted from a concern of teachers in isolated classrooms to a concern of policymakers, pundits, and activists in the public arena. Teachers, once left to their own devices to figure out how to meet the needs of students and prepare them for life after compulsory schooling (Lortie, 2002), have become line items in State of the Union addresses, a major source of contentious political infighting (even in once union blue states like Michigan), and the primary audience for an exploding school reform industry. The federal government now invests billions of dollars into holding states accountable for student achievement on standardized tests and in helping states, districts, and school reformers improve student outcomes on those tests.

Since 2009, three federal competitive programs have encouraged reform and innovation in teaching and learning: Race to the Top, the School Improvement Grant program, and the Investing in Innovation Fund (i3) program. Each of these programs provides incentives for educators to pursue school reform initiatives that are likely to improve teaching and, in turn, student learning as demonstrated on state accountability assessments. All of this investment has occurred in the face of decades of research that points to the difficulties of designing models for, supporting, and implementing school reform that leads to successful change in teacher practice (Berman & McLaughlin, 1976; Cohen & Moffitt, 2009; Elmore, 2004; McLaughlin, 1976).

A robust school reform industry, made up of charter school networks, nonprofit education organizations, commercial service providers, and home-grown professional development designers has answered the call for models meant to improve the ways in which teachers deliver instruction to K-12 students, particularly in the subjects of reading and math. One category of school reform involves hub-outlet organizations, in which a central hub develops a model for

improving teaching and learning, hires and trains coaches to support the development of that model, and implements its reform in unique outlet schools, sometimes throughout the entire country. While some of these hubs have developed models for particular educational disciplines, school settings, or student populations, others seek to influence teaching and learning across diverse contexts.

The work of these hubs and their outlet schools has been the subject of many studies of how school reform works – or does not – and why (Cohen & Ball, 2007; Glazer, 2009b; Glazer & Peurach, 2011; Peurach, 2011; Peurach & Glazer, 2011; Peurach, Lenhoff, & Glazer, 2012; Rowan, Camburn, & Barnes, 2004). This research provides considerable evidence that successful school reform is not a cut and dry endeavor, in which school leaders can systematically improve instruction by paying hub-based actors to design, support, and successfully implement new instructional practices in low-performing schools. Instead, the emerging consensus is that hub-outlet school reform is a complex, interactive process in which the interpretations, prior experiences, goals, and capabilities of outlet-based actors influence whether and how models of reform lead to predictable changes in practice across diverse outlets.

With increasing demands to prove that school reform models are able to produce the improved student outcomes called for in accountability and school improvement programs, it is essential for actors in both hubs and outlets to understand and make sense of this complex process. In particular, they must identify the mechanisms through which these interactions influence reform implementation and the ways in which they can improve their models to better insulate them from unpredictable or unwanted influence. As competition for school reform increases, and organizations must demonstrate their success in order to gain or maintain priority funding status, they must learn how to adapt their models to the greatest effect.

This dissertation is a series of three distinct but related chapters that explore the influences on school reform implementation through a case study of one hub-outlet high school reform organization called the New Tech Network. In particular, it builds on the school reform literature in three unique ways, illuminating the possible mechanisms through which the interactions between hubs and outlets influence the successful implementation of a whole-school reform model. Each chapter identifies ways in which the characteristics of hubs, outlets, models for reform, and environments may influence reform at every stage: initial adoption; training and development; and full scale implementation in classrooms. Taken as a whole, the story that emerges is a cautionary tale of how the work of reformers, often with the best of intentions, can be undermined, dismissed, or subverted, particularly when care is not given to how the hub itself can produce vulnerabilities to these influences.

In order to isolate the various mechanisms that influence reform, it was necessary to subjugate the findings from the other chapters when analyzing the mechanisms in each. This allowed me to examine influences on reform independent of each other. In reality, though, these influences work simultaneously and compound the degree to which reform is influenced. In Chapter 1, for instance, I explore how outlet-based staff interpret and make meaning of reform through a process of sensemaking. These cognitive acts result in a kind of co-construction of reform, so that the idea of a single core model is made to be a myth in implementation. Evidence from this chapter has important implications for the findings in the following two chapters, where I examine how a reform organization provides supports for necessary educational infrastructure and how change in teachers' practice is mediated by the type and purpose of reform. When thinking about the implications of this study, then, it is important to consider how

the mechanisms identified across the chapters could be working together or at cross-purposes to challenge the likelihood of success in school reform.

Reading across these chapters, one theme that emerges is that the myriad actors involved in school reform have created renewed tensions among the competing goals of education, in some unexpected ways. As policymakers have pushed concerns of teaching and learning into the public arena, beliefs about the purposes of schooling have been debated, challenged, and undermined. Federal and state accountability policy has focused on the goal of improved student learning on standardized tests. Teachers interviewed for this study indicated that they had adopted this goal, as well – if not out of conviction then out of acceptance that the goal was important to their continued professional stability.

But not all school reforms are established with this same goal in mind. Indeed, the New Tech Network espouses the goal of preparing students for a 21st Century knowledge economy in which critical thinking and communication skills will be more important than content knowledge. This orientation resonated with teachers' desires to engage students, make learning fun, and, in many cases, harken back to the days when they were free to decide what and how to teach their students. But, for many teachers, this goal came in direct conflict with external demands to improve student learning on standardized tests. Although some teachers seemed capable of working toward both goals at once, others saw the goals as mutually exclusive and, therefore, were forced to choose between them. These choices have important implications for student learning, since acceptance of one goal in this scenario means the dismissal of another. As reformers become increasingly present in decisions about what and how teachers teach, they must consider how their beliefs in the purposes of schooling may be misunderstood or dismissed in the hyper-politicized context of current schools.

Concurrently, policymakers with the power to decree what kind of learning is most valued in school accountability systems must begin to understand how legislation and governmental investment influence the operationalized goals of public schools. These goals are consequential to the opportunities available to students to learn wide-ranging content and skills, by wide-ranging methods. While choices about goals will always be necessary, evidence from this study reveals that there have been unnecessary trade-offs in the competition for goal dominance.

Rather than a mutually exclusive either/or proposition, the goals of public schools can be negotiated in such ways that no one is completely subordinated to another. How reformers formalize their models for instruction, provide supports for educational infrastructure, and design practice around the purposes of schooling can all affect the extent to which teachers must choose between competing goals. By entering into the public arena, and engaging in the work of school reform, they have a responsibility to consider how their methods and organizational dynamics create conditions in which teachers can successfully fulfill the goals of their models while simultaneously meeting the demands of externally defined goals.

The following chapters begin to unpack the mechanisms and processes through which school reform enters schools and affects teaching and learning, illuminating some ways that reformers can take special care in ensuring that their models do not force teachers into precarious situations in which no choice is a good choice. By analyzing the work of hub-outlet school reformers through three distinct lenses, this study adds to the academic and public conversation about what we value in public education, how we might create the most promising conditions for success in schools, and how hubs and outlets can work better together to ensure improved teaching and learning for all students.

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CHAPTER 1

The Co-Construction of School Reform: An Analysis of the New Tech Network Model

In recent years, the federal government has invested considerable resources in the promise of external education organizations that seek to improve student outcomes by providing schools with scaled-up "models" for reform. From the Knowledge is Power Program (KIPP) to Success for All, which both received $50 million i3 scale-up grants in 2010, to Knowledge Works, a 2011 i3 development winner, the federal government has recognized and rewarded the development of non-governmental education reform (McNeil, 2010). Districts and schools, too, are increasingly seeking the knowledge of external providers to help teachers improve instruction and, in turn, increase student achievement as measured through accountability systems. As these external education organizations grow ever-more present in the educational landscape, school decision-makers, such as building principals, superintendents, and state department of education actors must filter the available information to make choices about which programs to promote, invest in, and rely upon to help build capabilities for large-scale school improvement. How these organizations conceive of schooling – and convince funders to conceive of it – raises questions about the value of these investments and the justification of future external partnerships.

The hub-outlet version of education reform, in which a central hub organization works with outlet school sites, is often characterized in terms of "replicating" a common organizational model across varying contexts, and bringing that model to "scale." Indeed, the notion of replication is central to the rigorous evaluation demands on such enterprises, as private foundation investments and government funding are increasingly tied to evidence of impact on student learning, in the form of studies that seek to validate the model and its treatment effects. These studies and interested parties typically call for high fidelity implementation, an assumption

that, in order for a model to be replicable, it must be interpreted and implemented in much the same way across contexts.

In addition, the notion of replication is central to the interests of practitioners considering adopting models for reform, who look to documented evidence and observational experience to determine whether they want to bring what they see in other contexts to their own, often struggling, schools. Federal incentives – such as the School Improvement Grant initiative – and new state policies – like interventions required of Priority and Focus schools under No Child Left Behind flexibility – make partnering with hubs more attractive to schools. And their decisions to adopt a particular model are highly dependent on their belief in the ability to replicate the model as they interpret it.

There is much to suggest, however, that notions of faithfully replicating an organizational model and establishing treatment effects lack attention to the difficulty of high fidelity implementation in the way that it is typically conceived. For example, seminal research on education reform speaks to pragmatic needs that drive mutual adaptation, wherein the outlet context influences the nature of the model and the influences of those contexts drive reformers to adapt the model to suit differing needs (Berman & McLaughlin, 1976; McLaughlin, 1976). Further, more recent research begins to unpack implementation of school reform as filtered through the cognitive processes of sensemaking among both hub and outlet actors that result in variable understandings of the essential components of reform models. These various interpretations have implications for what actors implement across settings as "the model."

The purpose of this paper is to further conceptualize features of models, outlets, environments, and hub organizations that are consequential for this type of sensemaking and resulting co-construction across schools. The paper has four parts. It opens with a literature

review that raises key questions for empirical investigation of externally sponsored models of reform. It details methods used to conduct an exploratory case study of one such hub-outlet enterprise (the New Tech Network) to investigate these questions. It reports findings from a two-year period of this case study. Finally, it discusses the implications of the findings on research and educational practice related to replicating and scaling up models of reform.

The central theme that emerges from this analysis is that models for reform in schools are co-constructed through a process of sensemaking among actors in both hubs and outlets, so that the core model is not the same in any two contexts. Evidence suggests that the variation in the model is a function of outlet contexts, and also a function of the characteristics of the hub organization and the delivery methods used to convey the model to practitioners. This study brings evidence to bear that is relevant for both reform organizations and the educators seeking to adopt their models, as they determine how and in which ways to replicate, as well as how to demonstrate their value to varied school actors.

Literature Review

Many schools (especially underperforming schools) do not have the capacity to support large-scale instructional improvement with only internal resources. The technical core of teaching, or "how teachers understand the nature of knowledge and the student's role in learning, and how these ideas about knowledge and learning are manifested in teaching and classwork," is difficult to change, especially at scale (Elmore, 2004). Teachers, who are typically left to develop and implement the technical core of their work in isolation, often do not have the requisite knowledge and skill to improve their practice, and they have limited resources, time, and, money to invest in experiences that would help them improve (McDonnell & Elmore, 1987; Shulman, 1983). Schools have historically lacked coherent models of instruction, professional development,

or formative feedback mechanisms to support teachers' instructional growth. Principals and other administrative staff often lack the expertise and time to be effective instructional leaders, and schools often lack routines for collaboration, planning, and curriculum implementation (Kennedy, 2005). Put differently, these schools lack essential educational infrastructure: i.e., systems of interdependent resources that support the performance and improvement of the core work of teaching and learning (Cohen & Moffitt, 2009).

With few opportunities for improvement in-house, schools often rely on their external environment, including the school district, community, and state, to provide resources, expertise, and financial support for school reform efforts. Increasingly, districts have been supplementing this support by contracting with external educational agencies that have developed "models" for reform. These "hub" organizations serve as the designers and propagators of models and of staff to support implementation work with "outlet" schools to develop teachers' abilities to instruct students using methods thought to improve student outcomes, especially standardized assessment scores, graduation rates, and college attainment. But there is variation in the degree and depth of knowledge hubs contain and require in order to successfully implement models at scale (Peurach & Glazer, 2011).

The models for instructional improvement these organizations provide are not adopted in isolation. They are influenced heavily by the philosophy and style of the hub organization itself, so that the nature of the reform is reflective of the design for instruction and the external organization's norms, choices, and priorities. The way the model is implemented, in turn, is influenced by the interactions between it, the larger environment in which the reform takes place, and the outlet and its actors (see Figure 1).

But research over the last two decades has made suspect the notion that educators can simply adopt a reform model wholesale. Indeed, problems of replication; problems of coherence, elaboration, and scaffolding of the model itself; problems of capability within schools; and problems related to the nature of objectivity in the creation and implementation of a model all create obstacles to what external evaluators often call high-fidelity implementation (Cohen & Ball, 2007; Datnow, Hubbard, & Mehan, 1998; Peurach & Glazer, 2011; Spillane, 2004). These problems provide challenges to those trying to understand the impact of "a model" on a particular setting. Of particular interest for this analysis is the design for replication of a model, how actors in a hub and outlets make sense of the model, and the construction of the model in different contexts, all of which may result in variable results in implementation.

Replication

The extent to which any externally-sponsored instructional model is able to effectively improve practice over time and at scale is highly dependent upon the hub organization's ability to ensure commitment to a particular set of core principles that make up the reform model. The external nature of hub-produced models of reform is only tangentially important to the likelihood of adoption and successful implementation. Even among school-based reforms, challenges of replication are likely to arise (Peurach & Glazer, 2011).

Replication, as described in the organizational literature, is often used to characterize businesses that create and operate a "large number of similar outlets that deliver a product or perform a service" (Winter & Szulanski, 2001, p. 730). In these cases, the hub organization attempts to replicate, in increasingly diverse contexts, what made the original concept successful. A key feature of successful replication is the exploration phase, during which the replicators test out theories about what makes their model work in outlets, using what they learn to further refine

their model. Winter and Szulanski (2001) describe a replicable model's essential characteristics as its "Arrow core." These refinements, in turn, help replicators determine what should be the characteristics of template sites – or those sites that can serve as prototypes for new outlets. In education reform enterprises, templates are often historical templates, or the original schools in which the reform was implemented.

The routines and mechanisms that make a model work are often difficult to ascertain through observation of just one template. Indeed, the idiosyncrasies of a particular site may seem important to the success of future sites, but they may in fact be unimportant or even detrimental to future success. In other cases, they may be important but not reasonably replicable, such as the sparkling personality of an historical template's leader. Because the "product" of increased student learning in schools is hugely complex, characteristics of the core model and the unimportant idiosyncrasies are particularly difficult to tease out.

In public school reform, the employees who must carry out implementation of reform models are typically not hired by the hub organization, and their work is influenced through various contexts, such as previous experience in schools, prior school culture, student preparedness, and material resources. All of these variables make the identification and subsequent communication of a model's core characteristics that much more difficult in school settings.

Sensemaking

Research on how educators make sense of school reform initiatives complicates matters even further due to the complexity of the sensemaking process. Sensemaking is a cognitive process through which participants, working with and among other people, negotiate reality and come to an understanding of what it is (Weick, 1995). These articulated understandings serve as

springboards to action and heavily influence how actors implement what they have understood to be important (Weick, 1995; Weick, Sutcliffe, & Obstfeld, 2005). Actors describe events and their interpretations of those events and, though interaction with others, refine and adapt their interpretations. In this way, seemingly insignificant components of an instructional model and can have huge consequences for implementation in outlets, due to the various interpretations applied to those components (Brown & Duguid, 1991; Weick, et al., 2005). This means that how an instructional model is described and then interpreted by actors in both hubs and outlets influences the degree to which coherent and systematic replication is possible. Since the act of sensemaking relies on interpretation of all inputs – including those that may seem inconsequential – it is even more important that reformers seeking to replicate models are as clear as possible about the essential and nonessential components of the core model (Weick, 1995; Weick, et al., 2005; Winter & Szulanski, 2001).

Interpretation of reform is highly dependent on the beliefs of diverse members, but also on the reasons for and methods by which they agreed to adopt the reform (Datnow, et al., 1998). Datnow, et al. (1998) argue that different interpretations of why a reform was chosen (or why a particular reform "chose" a school) leave practitioners at wildly different starting points when beginning to interpret what the reform is all about. When the hub itself is not yet clear on the core characteristics of the model, it is highly likely that participants will supplant gaps in knowledge with their own impressions of what is "core" and what is "idiosyncratic." When this happens, hubs and outlets begin to separate from each other so that new outlets may barely resemble templates. An example would be a McDonald's restaurant that called itself a McDonald's but whose logo was blue and pink and whose main food offerings were pizza and nachos. This kind of misalignment, due to different interpretations of the core model, can affect

both the successful implementation of a reform and the ability of researchers to conduct impact analyses on "the model." Huge differences between sites can also have potentially detrimental effects on the hub's ability to learn about and refine its core and continue to promote its model in other outlets.

If actors use sensemaking to determine how to act in the future, their interpretations and the meaning they give them ultimately influence what is considered essential or arbitrary in the core components of an outlet-based reform. Actors are particularly dependent on sensemaking when there are many unknowns and they are attempting to figure out the meaning of events on their beliefs and future behaviors. Viewed within the context of school reform, it is likely that gaps in specificity of the model are positively related to actors' attempts at sensemaking, causing them to rely more heavily on interactions with colleagues and attempts at refining interpretations. This may lead to greater misidentification of the model's core characteristics. In addition, the capability of actors in the hub and core, and their experience with particular language to describe the model or events that transpire within the model – such as training – influence the frequency of gaps in knowledge, with additional implications for how a reform is interpreted.

Co-Construction

Although sensemaking research emphasizes the importance of clearly articulating core model components, in order to more precisely influence interpretation, research on replication indicates that the core characteristics of replicable models are often not completely known, both to actors in hubs and in outlets. These gaps in understanding of the core model are why replicators seek test cases through their templates and outlets and continuously adapt what they consider "core." But instructional models are not just interpretation. Rather, interpretation is the antecedent to action – or what actors do in response to their interpretations. Therefore, the

cognitive acts of sensemaking described above, combined with the formal materials provided by hubs, result in a co-construction of reform models in outlets (Datnow, 2006; Honig, 2006). Co-construction, then, is the tangible action of building a new model.

School reform enters schools through many channels, and, often, educators must grapple with competing messages about multiple ways of teaching that influence how they interpret any one message or model (Coburn, 2001). When educators receive incongruent messages about the core model being replicated, they combine their interpretations in order to construct a negotiated model in implementation (Datnow, 2006; Datnow & Castellano, 2000; Datnow, et al., 1998). Outlet-based actors do not negotiate this new model in isolation. In fact, most school reform models depend on the involvement of hub-based actors working in schools to communicate messages about the model (Datnow, 2006). These interactions among and between school-based and hub-based actors influence the co-construction of the reform model. As reformers continue to refine the core components of their models, and develop new models to replicate, it's important to understand how their structures and functions may play a role in the messages educators receive about essential and idiosyncratic features of models – and the templates that represent them. It is equally important to understand these dynamics as educators and policymakers invest in externally sponsored school reforms – and seek evidence of the impact of models on student outcomes.

Research Questions

This paper explores the characteristics of a school reform hub organization, focusing on the complexities of replicating an instructional model at scale. It examines the history of and scale up of one particular hub-outlet organization and its instructional model and uses the descriptions of hub and outlet personnel to explore how the reform is interpreted among diverse

actors and ultimately co-constructed in implementation. This paper begins to answer the questions:

- How do hub- and outlet-based school reform actors interpret a core instructional model through a process of sensemaking?
- What features of hubs, outlets, environments, and the model itself explain variation in how the model is co-constructed across diverse sites?

Methods

Because the aims of this study center on how an instructional model is interpreted by members of its hub and its outlets and why variation exists across diverse sites, it was appropriate to investigate New Tech as it scaled up its model in schools. Yin (2009) writes that studies of contemporaneous phenomena leave researchers with little control over how events play out, requiring methods that allow for flexibility and the ability to follow evidence to unexpected places – the case study approach. In addition, because sensemaking is executed in the act of voicing thoughts and interpretations, it required contemporaneous methods that would allow me to understand the context of interpretations. Therefore, I look both at the formalized resources New Tech has designed to describe and implement its model, and I examine the interpretations of those resources by educators in the New Tech hub and outlet schools.

The primary research method used is organizational ethnography, a contextual investigation of the ways in which structure impacts human behavior. This study posits that the structure and characteristics of New Tech interact with and among the environment, outlets, and New Tech's own design for reform, and these interactions are best-observed and documented through up-close, reactive data collection. This study incorporates data from participant-observations, interviews, informal conversations, and New Tech documents, both nationally-

sponsored and locally-developed. I intentionally conducted participant-observations, rather than attempted to strictly observe. Because this study involved many hours of observation in meetings, classrooms, and coaching sessions, I wanted to learn from my subjects but also be able to provide them with reflections on what I had seen that might help them in their efforts to reform their schools. I undertook an "observer as participant" orientation, wherein all subjects were aware of my status as a researcher, the extent of knowledge of my research was variable among subjects, and I participated both when asked to participate and when my observations prompted questions that would help to facilitate the work being undertaken (Atkinson & Hammersley, 1994; Gold, 1958; Junker, 1960). The bulk of my participation consisted of asking questions, both to help me better understand events taking place and to help my research subjects think more broadly about their experiences. All observations cited in this paper are the result of participant-observation.

Case

While there are many organizations working with schools across the country to improve teachers' instructional practices, this study required an organization that: had developed a unique instructional model; integrated coaching and development strategies; and model tenets at multiple levels of educational systems. In addition, the organization had to be large enough to provide variation across school contexts. Finally, the organization had to be willing to allow researchers to investigate its program, coaching, staff, and implementation at many levels. The New Tech Network, in summer 2010, agreed to be the case for this investigation.

I began this study with introductions to New Tech executives and coordinators at the state level. After spending several days in summer 2010 at New Tech's training conference for new schools, New Schools Training, I discerned that the organization had developed a wide-ranging

set of resources for intervening into schooling and that they were interested in whole-school reform, rather than just instructional intervention. In addition, the organization at first blush appeared to have potential for changing teacher practice and influencing organizational change toward their goals. In other words, I felt New Tech had promise for improving schools and student outcomes. Early student achievement and graduation rate data suggested that New Tech schools were affecting positive change to student outcomes in some areas. New Tech also seemed to have clear standards of success that went beyond traditional student achievement outcomes. The organization wanted to create high school graduates who were strong critical thinkers, effective communicators, and strategic problem-solvers – all of the outcomes business leaders in the Napa community of the original New Tech site asked for of their public schools.

These initial observations of the organization made me interested in digging deeper into what New Tech offered districts, schools, and teachers. Six districts in my home state of Michigan had signed on to open New Tech schools in 2010, and the organization was in talks with several other Michigan districts for school openings in 2011, five of which eventually signed on to implement New Tech. Across the country, the 2010-2011 school year saw New Tech scale-up from 35 to 62 schools, an increase of 27 schools, or 77% of its previous reach. Recognition and investment from the federal government had garnered both New Tech and its new operating organization, Knowledge Works, credibility in the school reform marketplace. The time was ripe for New Tech and for a serious investigation into what the organization could teach us about enacting secondary school reform.

After getting approval from New Tech executives, I gained approval from the intermediate district facilitator who had helped secure state resources to pay for the first year of New Tech fees and coordinating sessions for collaboration and networking among school

directors (New Tech's word for principals). With her agreement to be a research subject and to allow me to conduct research in schools, I then pursued the Michigan districts that had adopted New Tech for the 2010-2011 school year. Resources would not allow for in-depth analysis in all six schools, so I focused on recruiting three high schools that would provide variation among student demographics, location, and school configuration. At the first two schools I approached – School 1 and School 2 – the district and school directors signed on immediately. Officials at the third high school I approached, which was located in a working-class neighborhood near an urban center, declined to participate due to over-exposure from researchers in other district schools. On the advice of the intermediate district facilitator, I then approached School 3, which agreed to participate.

Because the New Tech model does not mandate a specific type of configuration, I was able to study three different takes on school design. Each school represented one of the three most common configurations in New Tech schools across the country – new school, school-within-a-school, and whole-school conversion. For each school, I gained written approval from the district superintendent and director to conduct observations of classroom practice, staff meetings, and New Tech training experiences. In addition to the superintendent and director, I also gained permission to interview at least three teachers in each school during the 2010-2011 school year. Informal follow-up conversations and email correspondences were conducted in the 2011-2012 school year.

Finally, I gained permission to observe and interview the New Tech school development coach for all three schools, Emily. As the main intermediary between the New Tech Network and the school sites that were implementing the reform in Michigan, Emily is a principle figure in this study. Many observations of instructional practice and staff meetings were conducted in

conjunction with her school site visits, and she provided much of this study's initial evidence for New Tech staffers' interpretations and communication of its model, whether schools were implementing the model in appropriate ways, and what the organization was learning from implementation. In addition, Emily agreed to participate in both formal interviews and informal conversations throughout the study. She willingly served as a check on my understandings about the organization and about what I observed, and I, in turn, served as a sounding board for her as she developed as a coach in her first two years on the job.

Data

I formally interviewed the leaders of each school in the study, in addition to at least three teachers in all three schools and at least one person from the leadership team. In two schools, I was able to interview both the superintendents and the principals. I also interviewed Emily and two district coordinators of New Tech in Michigan. My informal conversations and observations of discussions about New Tech from New Tech staffers and school-based staffers were documented in observation notes. For each formal interview, there was an informal follow-up conducted in which understandings and impressions from the interview were exchanged, as an assurance that I was capturing the true meaning of statements. I also spent more than 60 hours in the three Michigan New Tech schools observing and listening to teacher practice and student experiences in New Tech classrooms.

I observed four staff meetings in each school, all facilitated by Emily. Finally, I observed two weeklong summer training sessions for new schools; three formal professional development events throughout the school year, called Meeting of the Minds; and one formal presentation given by the 2010 Michigan school directors at an educational technology conference. For each observation, I took extensive notes with a protocol that included the purpose, location,

background, agenda, participants, formal research subjects, materials, observations, conversations, questions, and follow-up tasks. Informal conversations that occurred as a result of participant-observation were recorded in the "conversations" section of the note-taking protocol. In addition to general observations, I noted decision-making processes related to the New Tech model among teachers, leaders, and New Tech staff; structural or organizational obstacles to implementation; and variance in New Tech support depending on school context. I read, edited, and made clarifications to these notes following each observation.

All transcripts and observation notes were uploaded into a Dedoose data analysis system and were coded and analyzed in such a way that would illuminate evidence of how, why, and to what ends the New Tech model was interpreted by actors in the hub and three outlet schools (Dedoose, 2012). I used unique codes for stated perceptions about the instructional and leadership practices in the model, as well as the goals of the organization. These codes – such as "why new Tech," "New Tech structure," "New Tech characteristic," and "teacher variability" – allowed me to synthesize themes across my data (see Table 2 for a full description of the codes used).

I developed relationships with the directors and coaching staff of these three schools over the course of two school years, and I continue to learn from them as they undertake the difficult work of school reform. The three schools that agreed to fully participate in this study provided very different contexts with which to observe New Tech's influence. School 1, located in a midsize suburb, was a school-within-a-school, a second small school within the larger community high school. School 2, located in a small city, was a new school that recruited students from the traditional high school nearby. Finally, School 3, located in a large suburb near an urban center, was a whole-school conversion, in which all students and teachers in the school

adopted New Tech over a two-year period. The true names of the schools and participants in this study have been concealed to protect their identity. Characteristics of the schools are described in Table 1.

Findings

I report my findings in five sections. First, I describe the history of New Tech. Second, I describe how its model for reform was formalized by the hub organization. Third, I describe the model as interpreted by New Tech staffers. Fourth, I describe the model as interpreted by teachers and leaders in three outlet schools. Lastly, I look across the preceding findings to identify three primary influences that account for variability in interpretations across sites.

History

The New Tech Network is a national school improvement organization based in Napa, California. Founded by business and community members in collaboration with educators, New Tech began as one school in 1996 – Napa New Technology High School. In 2001, the Bill and Melinda Gates Foundation awarded New Tech a $6 million grant to begin scaling up its model of reform from one school to 14 over three years. New Tech has rapidly grown since then and now supports 105 schools, mostly high schools, in 17 states, with the largest clusters in California, Texas, and Indiana (New Tech Network, 2012c). New Tech also supports 14 schools through New York City's iZone initiative. While not official New Tech schools, New Tech coaches (including those in this study), staff, and designers are deeply involved in implementation efforts in the iZone. When this study began in 2010, New Tech established its largest new cohort of schools – 27 – representing a 77 percent growth in one year. That year, New Tech launched its first six schools in Michigan, a sample of which are the focus of this study. As of fall 2012,

Michigan had 10 New Tech schools, including one of New Tech's seven new middle schools across the country.

The New Tech Network grew out of a desire by community business leaders to better prepare students for the highly volatile technology-driven economy that had emerged in the previous decade. While students in Napa were meeting requirements, graduating, and, often, going to college, leaders felt that there was a gap in students' ability to think critically, problem-solve, and communicate their own ideas. In collaboration with teachers at the high school, they began to design a three-tiered school reform model focused on: project-based instruction, collaborative school culture, and engaging technology. The guiding principle for this work was that students needed to be fully invested in relevant learning in order to promote the skills and knowledge required in the new economy. New Tech strived to craft a model that built on student interest and prior knowledge so that students would be fully engaged in their learning.

Formalized "Core" Model

New Tech's historical template – its original school in Napa, California – and its formal promotional, training, and implementation resources provide evidence for how the hub organization has attempted to define its core model for replication in schools. This version of the model is nascent and incomplete, since it is through the process of replication that an organization's beliefs about its essential characteristics are tested and refined. So, it is only "core" insofar as it includes what the hub organization has determined is essential enough to include in formal materials used for replication. Therefore, this section relies heavily on those formal materials, training procedures, descriptions of New Tech's organizational structure, and characteristics of its historical template to explore how the hub has characterized its model to internal and external actors.

New Tech's formalized core model can be outlined in three parts: principles; processes; and language cues that bring some intuition to model tenets. The principles of the New Tech model were grounded in 21st Century skills, as made popular by education reformers and pop psychologists. The processes were heavily derived from the Buck Institute's model for project-based learning. The language cues, or catchy phrases that helped actors remember core tenets and begin to act intuitively on them, were imbedded in New Tech's coaching schema and formal written documents.

New Tech described its principles as being based on 21st Century skills, which were formalized in many of New Tech's documents and training materials. Referenced by New Tech staffers as being influenced by Adria Steinberg (1998) and Tony Wagner (2010), 21st Century skills were meant to serve as a guide to what and how students are measured as making progress in the New Tech model. During New Schools Training 2010, new teachers were given Steinberg's (1998) "6 A's" to consider as they developed their first projects: Authenticity, Academic Rigor, Applied Learning, Active Exploration, Adult Connections, Assessment Practices, Use of Technology. These "A's" were used throughout training materials to codify some of the core characteristics of the New Tech model, from the perspective of the hub. They also made their way into some of the language cues that New Tech trainers used to help make the model more intuitive to practitioners.

The New Tech Network described its instructional model as a project-based learning process approach. As defined in New Tech documents and expressed in New Tech trainings, project-based learning was a pedagogical orientation that positioned the teacher as facilitator

rather than leader. It was based on the Buck Institute's model for project-based learning, described on its website as follows:

> In Project Based Learning (PBL), students go through an extended process of inquiry in response to a complex question, problem, or challenge. While allowing for some degree of student "voice and choice," rigorous projects are carefully planned, managed, and assessed to help students learn key academic content, practice 21st Century Skills (such as collaboration, communication & critical thinking), and create high-quality, authentic products & presentations. (Buck Institute for Education, 2012)

New Tech provided written materials that documented "essential" steps for New Tech teachers to carry out in enacting project-based learning. These steps included: capture students' interest through an entry document that helps them think about what they need to know; develop learning outcomes that will guide how a teacher measures success on the project; engage students in inquiry; require students to innovate; give students a meaningful "driving question" to guide their work; encourage students to make their own decisions about how to proceed with the project; require students to give a public presentation to explain their findings; confront "significant content and authentic issues;" and "incorporate critique and revision."

In its training sessions and in a formal document called a "school success rubric," New Tech specified that courses be co-curricular, meaning that teachers with specialties in different content areas would teach combined classes with joint instructional projects. New Tech did not indicate which content areas should be combined. Templates within the organization had various arrangements, such as Biology and Literature; American Studies and English; and Physics and Geometry.

In New Tech's formal documents, the project-based learning tenets were described as a series of processes that New Tech teachers and principals could enact. Steps in formalized processes were documented as guidance for teachers; explicit instructions for teacher behavior were rare. New Tech's formal documents also described processes related to Echo, the organization's online learning portal. In New Tech's formal Teacher Success Rubric, teachers' practice was not described as "proficient" unless teachers used Echo's online course calendar to drive all classroom activities, for example. New Tech operationalized Echo and its use as an essential component of what it tested as its core model in schools.

New Tech used verbal cues in its training protocols and documents, to assist teachers in interpreting what they were meant to do. Formal training materials used words such as "authentic" and "relevant" to describe the kinds of activities students should be asked to do within projects, as well as the products students would produce and the audience to which they would present their projects when they were complete. In fact, the word "authentic" was used three times in one training document, to describe advanced teacher practice in New Tech's rubric for teachers. At New Schools Training in 2010, a high-level New Tech staff member described the New Tech classroom as "a mirror of the workplace in school." Indeed, formal documents indicated that one essential component of the established core model was "preparing students for the 21st Century work environment." The organization also characterized its model as "hands-on," "tech-savvy," and "student-driven," words that helped to "sell" the model to outlet schools and districts.

Hub-Based Interpretations

During the course of this study, the New Tech Network was organized as a diffuse hierarchical structure, in which its more than 50 employees lived and worked mostly remotely throughout the country. Its leadership team was small, with the largest concentration of

employees on the school design and implementation team. As of the beginning of the 2012 school year, New Tech employed 18 full-time school development coaches, who served as the principal links between outlet schools and the New Tech organization. The Network trained its school development coaches in much the same way the coaches were expected to engage in training with educators in outlet schools. New Tech coaches described this method as "cognitive coaching," in which a facilitator or coach asks questions to drive participants to certain decisions, which are not typically predetermined by the facilitator. There was a great deal of freedom given to participants to decide on appropriate courses of action. The facilitator served as just that – one who facilitated rather than dictated instructions. Because its training methods relied on social processes to convey model principles, New Tech staffers had their own interpretations of the New Tech model that varied in relation to prior experiences and school context. In this section, I use the words of New Tech staffers to illustrate how members of the hub organization interpreted the essential components of New Tech's core model through a sensemaking process negotiated among colleagues and outlet-based actors.

Emily, the school development coach who was the main contact for the New Tech schools in this study, described New Tech's philosophy as a complete giving-over of control to teachers in the model and, in turn, students of those teachers. She argued that the role of the organization was to help create the conditions necessary to promote free thought and experimentation, through which students would eventually learn what they were meant to learn. As she explained:

> Students are going to figure a lot of those things out through their own exploration and research if you set up a project correctly. So there are a lot of things that you don't need

to explicitly teach. If you've structured a project appropriately, students will access that information on their own.

This description reflects what other New Tech staffers described as a "process over content" mentality. At the 2010 New Schools training, New Tech coaches were observed encouraging new teachers not to worry about knowing the content of their subjects as much as how they teach it and how they help their students learn it: "You are not being graded on your content knowledge; focus on the process." In particular, New Tech training was almost exclusively focused on the many processes that a new teacher would have to master in order to successfully implement the model, including: a know/need to know process; a "critical friends" process; a process to facilitate discourse; a decision-making process; and a data-collection process. New Tech staffers were often heard encouraging new teachers by exclaiming, "Trust the process!"

Even when confronted with teachers' concerns that they would not "cover" all of the state required content in their courses, Emily's response was consistent throughout my observations: coverage is less important than giving students opportunities to discover learning independently through the "project-based learning process." She argued that this process of discovery would lead to adoption of the 21st Century learning skills New Tech asked each school to promote and assess.

The project design process was the process most often discussed by New Tech staffers, both when asked to describe the New Tech model and when coaches worked with teachers during school site visits. When asked to describe it, Emily said:

> So the project design process starts at project ideation and 'beginning with the end in mind' what that product is going to be. You're taking into consideration content objectives and 21st Century skills. And then all of the objectives that you determine, there

> needs to be some kind of formative assessment essentially, I guess we can call them, that are going to lead students along the way to be able to really be set up for success in the end.

In the words of its staffers, New Tech teachers should design projects by considering what they want the end product to be, which content objectives and 21st Century skills they want students to learn, and how they will assess students' learning. New Tech staffers' sensemaking of the project design process was often voiced in repeatable, memorable phrases – like "beginning with the end in mind" – some of which were derived from formal New Tech documents and some of which were created ad hoc, to facilitate engagement.

The principle illustrated most often as a core component of New Tech's model was indicated in the phrase "the answer is around the table." New Tech coaches described their role as "facilitator" rather than "trainer" or "teacher." Emily said, "I'm basically there to answer any questions along the way. It's more about asking the right questions to get them to come to their own conclusions the way I want them to." This back-seat approach was verbalized often as explanation for how New Tech's model would instill necessary skills among high school students. As Emily said, "We have to use our curriculum to create opportunities for students to learn things that are relevant to them." In this way, the principles of New Tech's model were not explicitly verbalized as often as they were indicated through the catch-phrases described previously. New Tech staffers warned teachers not to be "the sage on the stage," but, rather, "the guide on the side." These catchy phrases represented the sensemaking of New Tech staffers, as they attempted to verbalize the essential components of the model in their interactions with each other and with outlet-based staff.

Outlet-Based Interpretations

Outlet-based staff, including teachers, directors, and superintendents in the three New Tech sites I observed, used both explicit and implicit sensemaking exercises to develop interpretations of the New Tech model and its core characteristics. After attending New Tech training and working with a school development coach for over six months, many of these actors had established verbalized descriptions of what they believed were essential components of the New Tech model. They used these interpretations to help them make decisions about how to behave within their New Tech roles and to justify certain behaviors when discussing their practice.

Teachers I observed used New Tech staffers' catch phrases as checks on their own understanding of the model – identifying weaknesses in their practice when they felt like they were slipping into more traditional lecturer roles or their students came to them for answers instead of seeking solutions on their own. This appropriation of New Tech language was observed at every school site, although it was most often heard in School 1, where language used to describe the New Tech model mirrored most closely that used by New Tech staffers themselves. This section will describe the ways in which actors in New Tech outlets made sense of the New Tech model, paying particular attention to the characteristics they identified as being core to the model. I analyze interpretations from actors within each school separately, since it is within these contexts that outlet-based staff most often engaged in a sensemaking process with their colleagues, negotiating meaning through discussions at staff meetings and informal conversations. For each school, I describe the initial process of adopting New Tech, as foundational evidence for outlet-based actors' interpretations and understandings.

School 1. At District 1, the reasons for adopting New Tech were both academic and personal. Ranked in the middle of the pack by the Michigan Department of Education's Top to

Bottom ranking, which incorporates student achievement, growth, and gaps between low- and high-performing students, the traditional high school in the district was not making any waves in 2009. Community members were relatively happy, but there was a growing sense that, with the downturn in the economy, competition for college spots and jobs would grow ever more staunch. ACT scores could have been better, and the time was ripe for a shake up. Tim, the superintendent at District 1, said:

> [The high school was] resting on its laurels a little bit. They were very proud of what they were doing and, actually, I think that was standing in the way of some improvements because it was one of these, 'It's not broken. Why do we have to fix it?' kind of a situation.

Tim decided to survey students in order to better understand their experiences in school. What he found was that the high school students in his district did not feel that their lessons were relevant to them. Students told him that they did not have strong relationships with adults in the building, and that concerned him. These revelations moved Tim to action. He convened a redesign team that included about 40 participants from the school and the community, and that team took steps to adopt a Rigor and Relevance model of schooling from the International Center for Leadership in Education.

The first major reform that emerged from the work of the School 1 redesign team was a "freshmen academy" concept that involved a school-within-a-school model for entering students. The idea was to give some freshmen the opportunity to learn in smaller classes, with a tight-knit group of teachers and peers in one wing of the large community high school. After the successful implementation of the freshmen academy (where they saw discipline referrals and failure rates drop), Tim continued to look for reforms that would better prepare his working- and middle-class

high school students for a 21st Century workplace. While at a conference in Texas in 2009, Tim's technology director and a member of the school board were taken on a tour of a New Tech high school. They came home to Michigan energized by what they saw, and they told Tim that New Tech might be the answer to their "relevance question." Tim remembered:

> They were mostly impressed with the kids and the kids' understanding of how they would use, could use, did use what they were learning, because of the project-based learning. That's the thing that – they didn't know at the time that that's really what it was, but, since we've learned the model ourselves, it's the project-based learning. It's the giving kids a project and tell them, "Here's kind of where you need to be. You've got to figure out how to get there," so that everything they learn that's designed to get them where they need to be is immediately applicable.

Tim was intrigued, and he investigated the possibility of bringing New Tech to District 1. He visited five New Tech schools – three in Indiana and two in California, the first and second New Tech schools. He was impressed with what he saw and heard. When asked what he saw that made him think New Tech was right for his school, he said:

> The kids were just so articulate in what they knew and what they learned. It was very impressive to see them, to hear them talk about their own learning. They really could articulate their own learning: why they learned; what they learned; what they needed to know; what the process meant to them. I also heard from teachers that talked about it as being almost the saving grace for them.

What Tim saw connected to his personal story – he had struggled academically in high school and college because, from his view, he did not feel that school was meaningful for him. He said that, had school been more relevant to his personal interests, he would have been more engaged.

While Tim spent a great deal of time in New Tech schools, mostly talking to students, he spent relatively little time with New Tech executives and staff members. He was attracted to how he saw students responding in New Tech schools, but he did not gather much information on what it took to achieve that degree of student engagement. In other words, the New Tech model for Tim was evidenced in student engagement and outcomes, not in coaching, professional development, or coordinated supports between the district and the organization. The need that Tim assessed at School 1 – relevance – could be addressed through a reform that resonated with his personal experience. He was sold; within six months of first learning about New Tech, he was recruiting a director and teachers, securing financing, and signing a contract for the school to open in 2010.

The director of School 1, who was among the first to commit to New Tech in Michigan, verbalized New Tech's philosophy in terms of replication. When asked to describe the New Tech model in his own words, he said:

> I think that the philosophy of the network is to try to replicate project-based learning in schools across the country, and I think the way they do that is with model replication in terms of core values and principles, and then providing support for the teaching staff and directors, to try to communicate best practices and share. The spirit of collaboration is real high in this network. I don't feel like it's competitive. […] It's, "What works for us here in our environment is this, you can try it." "It might not work in your environment or it might, you know just give it a shot." It's not, "We have all the answers." It's, "We learn together, and, if you have something to contribute, please do contribute it."

Key to this director's conception was that New Tech had an "it might work, it might not" approach to implementing its model and that it did not presume to have all of the "answers" to school improvement or even to the relevance question the superintendent sought to answer.

Instead, this director described the core of New Tech's model as being made up of values and principles that New Tech tried to instill in its outlets.

When asked to describe the New Tech model, a novice math teacher at School 1 described New Tech's model for instructional design, in which students would be "using computers and using technology and working in groups." To him, the core characteristics of the New Tech model had to do with the use of technology and the fact that students would work in groups. In fact, when asked about the applicability of students' projects, he dismissed the idea that one could design "authentic" math projects. He argued that this was not a high priority in the New Tech model. Rather, it was the tangible practices and technology that they used in their New Tech classrooms that tied the model together.

Similarly, a humanities teacher at School 1 described the New Tech model in terms of the ways in which it helped teachers demonstrate consistent practices in their classrooms.

> One of the advantages of the New Tech model is the consistency among the teachers within that model, which reinforces what each of us is trying to do individually in the classroom. The concept of culture is absolutely key to New Tech. That's not something I could have implemented before because I didn't have anything supporting me in that. My administrator at [my old school] actually paid a lot of attention to culture in general, but the culture that she was creating wasn't a project-based teaching environment.

The director of School 1 reiterated the importance of culture-building within New Tech. He said that New Tech allowed him to establish an environment focused on freedom and, in which the staff made almost all administrative decisions together, even which classes were offered and what classes were integrated.

In addition, the director of School 1 considered physical space to be especially important in his ability to understand the New Tech model. In early trips to template sites in California, including the historical template in Napa, he had not seen a building that resembled his own, in which the New Tech campus shared space with another school. Later in the adoption process, he finally felt like he understood how the physical characteristics of the New Tech model might work for him:

> The shared campus piece has been mentioned but it's not something that I actually see. So then, I went to principals' residency and I went to [Template] High School and it was just like our building. The building was newer than ours, it was only a couple of years old, 2006 I think is when it was built. Ours was built in '99, but they had the same hallway structure that we had set up, and so walking in there was not - I mean while their schedule is different than ours, […] I couldn't help but think, "Wow, we've really got some opportunities to replicate this model."

When he confronted a physical space that resembled his own, this director was able to envision the New Tech model in his school. This resonance seemed to impress upon the director that physical arrangements of New Tech schools could be essential to the core New Tech model. So, while the hub organization formalized very little about the physical space of its outlets – allowing such flexibility as stand-alone schools; conversion schools; and schools-within-schools – this director made sense of the New Tech model through his connections between the physical characteristics of a template and those of his own building.

School 2. At School 2, the reasons for adopting New Tech were less personal than at School 1. Neither the district superintendent nor the future director had an intimate connection to the particular reform model New Tech promoted. Rather, there was a perceived need to

experiment with new ways of running schools, in the hopes that lessons learned in those experiments might inform the traditional school settings in the area. The superintendent of District 2 recognized a need to better engage students from low-income and minority backgrounds in strong relationships with adults and "the same level of rigor and expectation" for academics that the district had for other students.

In the years leading up to the adoption of New Tech, School 2's director was the district's technology and finance leader. He was involved in the initial search for "options" that would help the district implement the changes that they thought were necessary, so he took the opportunity to explore New Tech while at an educational conference. Unlike at School 1, where the superintendent sought a relevant educational model to engage students, leaders in District 2 were most interested in "the ability for replication that New Tech offered." The director hoped that whatever new model they adopted would be a laboratory to experiment with educational reform that could expand beyond the initial trials. School 2 was not concerned about improving low achievement scores or wholly transforming a failing system. Instead, the director said:

> Our high school is not a failing high school. We have many many great things going on there. So we were looking to just enhance the current setting and actually improve where our students are learning from that standpoint. So we're not a year five school that's in failure. We're a school that has AP credits and a number of other things. We wanted to see what's the next step for us. How we can add to our students' education?

The district was interested in taking a few classrooms, with a few students and teachers, and trying to advance what they perceived as an already well-functioning school. They saw New Tech as an opportunity to practice new strategies for teaching and learning that they would then bring back to the community high school.

The director used a metaphor to describe this process that he hoped would occur in bringing in New Tech:

> New Tech is a small boat, our high school is a huge ocean liner. Our small opportunity to change a couple of classrooms and to really think outside the box, is much easier than trying to change all of secondary education at [District 2]. And we thought that it was necessary for us to try to get ahead of the change and do it in a small environment and be able to take that change and apply it back to the high school.

The superintendent and other district leaders believed that New Tech was an opportunity to try a new way of teaching, on a satellite campus, that could be used to jump-start change across other schools.

Actors in School 2 developed interpretations of core model components based on their initial impressions, informed by the change they hoped to see across the districts' schools. When asked to describe the New Tech model, the superintendent of District 2 said:

> I think [the model] is really taking teachers and changing the way in which they present information, from me being a teacher and I have my scope and sequence of curriculum, and I'm going to present that to you in a very traditional "here's a lecture, here's some homework, here's some quizzes, checkpoints, here's some more lecture, homework, and quizzes" very isolated discipline instructional format with a kind of assessment at the end, to developing real world project-based learning experiences, where the teacher actually becomes a facilitator of the learning and assists students in understanding what they already know and what they need to know to be able to solve some pretty complex problems, that take place over a longer period of time, three to four weeks let's say.

In describing what he believed the core model was, the superintendent used some of the same language used in New Tech trainings – "facilitator" and "knows and need to knows" – in particular. But the core characteristic he focused on was engagement. He said what characterized the model to him was "the ability to engage students to take ownership of their learning." He appreciated that "students become accountable to their peers and to each other and take a much more active approach to the learning." He also described the use of "technology as a tool or means to get there by making information much more readily accessible than it has in the past."

After a visit to an established New Tech school, a veteran math teacher at School 2 was impressed with what he saw. When asked to describe what he came away thinking about New Tech, he said:

> [The students] seemed to really be focused on learning and their education. I didn't see students out in the corner playing games on their computer or screwing around. I found a contrast between what was going on during class time and passing times because at passing times they acted just like any other high school or middle school student. I mean there was shrieking, and there was yelling, and there was nothing in a bad way, but they were very age appropriate at that time. But in the classrooms they seemed to be going about their education in a more mature fashion, and I was impressed with that. I also loved the facility.

This teacher's interpretation of the New Tech model focused on how New Tech inspired a certain maturity among high school students that was uncommon in his previous experiences. He indicated that this was a result of the cultural dimension of the model, wherein students were given flexibility within certain boundaries.

A veteran humanities teacher at School 2 described the open-endedness of the New Tech model – which he perceived as a core component – as "one of the pluses and minuses of New Tech." When asked to describe the model, he said:

> It seemed like it was very open in the sense that you could make it what you want it to be. I mean they have a general overall philosophy, but they didn't initially seem to be pushing you into something where it's very prescribed. Where you know, it's, "Okay, it's October and we do this." Or, "This is the course that you have to teach in the 11th grade year," or anything, it was nothing like that.

Other teachers expressed similar tension between the freedom New Tech offered to "go their own way" and the daunting task of choosing how and what to teach from the millions of possibilities available. This philosophy of open-endedness actually seemed to result in variable interpretations of the core components of New Tech's model. A different veteran humanities teacher from School 2 said that he wished there were more formal resources that would tell him how to go about designing projects. He explained that he was never clear on what the best practices and steps were, making him frustrated at not being able to deliver the kind of instruction he felt his students needed in order to learn the content he was charged to teach.

As described in the previous section, New Tech's formal documents indicated a core component of the model was the design and planning of projects before students are introduced to them. This contrasted with the typical work of teachers, which involved much more active teaching than planning. A veteran math teacher at School 2 thought that the "hard part" of project-based learning was "to dream [a project] up." He said, "The easy part is to make it authentic to fit it into what the topic that you want to be looking at, at that time."

Because of the inquiry-based nature of cognitive coaching, which seemed to result in the perception of open-endedness in the model, several of the educators I observed described project design in the form of questions. The director of School 2 described the project design phase this way:

> Well I think it needs to start with a driving question. It has to be something that would have an ability for the deep thinking components. The deep skills that are necessary. As we think about the next step beyond that, is once again, the driving question, we align it with the state standards and national standards that are required. And where that fits within how we deliver the model. In other words, what class is it in? Is it specific to math? Or is going to go across two classes?

He echoed the frame of two of his teachers, who also described project design in a series of questions. A veteran math teacher at School 2 said that, once he had a project idea, he would ask himself questions to design the rest of the unit:

> And then once you get that done then it's just nuts and bolts. What are the standards? What is my entry document going to look like? Am I allowed to bring somebody in from the real world or am I going to fake it and write a letter ostensibly from somebody in the real world to make it look authentic? What is the evaluation rubric going to look like based on our school wide learning outcomes? How do I want the students to present? What leeway will I give them? And then what type of instruction, mini lessons, scaffolding will I provide as I go through to make sure that they're getting as much as they can?

When asked to describe project-based learning, his colleague at School 2, a veteran humanities teacher, listed questions, as well:

> And so I get these ideas and then I start thinking about, well, what's the language arts end of this, or what's the history end of this? And does this fit any of the courses that I teach? And what kind of standards would be involved in this? And so for me, that's the first step. And then the next step is, well, what kind of product are we going to have and is there a way to connect this to somebody in our community? Because that makes a stronger project. Then the next step is, well, do kids know what they need to know to do this already? What kind of learning do they have to do? And then that's what they call the scaffolding, where you make up your mind about that kind of stuff.

By characterizing the core components of the New Tech model in terms of questions, these teachers seemed to indicate that the model was not any one set of components. Rather, these descriptions reveal an interpretation of the model that is inherently and purposefully variable. Perhaps the New Tech model, they seemed to be saying, was only what any particular teacher would do with it.

New Tech suggested that teachers implement scaffolding activities in between roll out and wrap up of a project, which are the supports, workshops, written activities, and interim goals that help students get from point A to point B within a project without limiting the range of their learning experiences. As a veteran humanities teacher at School 2 said:

> To scaffold it, if you're going to get to here, you need to take some steps to get to that point, and so those are the steps. Now a lot of times those might be represented as a mini lesson or I'll give them a reading or I'll direct them to some web resources for them to take a look at. Or I'll give them an activity. A lot of times it is led by me, but it's not always led by me.

In his view, scaffolding activities would be the "building blocks of getting to the point where they could execute the project in a really quality way." While New Tech referred to scaffolding in informal conversations with teachers, there were very few formalized documents indicating that scaffolding was seen by the hub organization as a core characteristic of the model.

School 3. School 3's decision to adopt New Tech was motivated by external pressures to improve student performance. As a school on Michigan's Persistently Lowest Achieving list in 2010, School 3 was eligible to apply for federal School Improvement Grant (SIG) monies, with the requirement that the school would adopt one of four "turnaround" strategies. Under the transformational improvement option, School 3 applied for and won a School Improvement Grant to work with the New Tech Network, one of Michigan's approved external service providers for the use of SIG funds. In essence, District 3 contracted with New Tech as a last-ditch effort to save the school from restructuring or closing. Instead of being a creative option for students in relatively well-performing schools, New Tech was brought on to be the "answer" to School 3's low achievement and graduation rates.

In the first year of implementation, School 3 had a director on the verge of retirement. Because this director had limited interest in launching a whole school reform, a veteran humanities teacher with some previous leadership training was identified as being a pseudo interim director. This was not a formal role, but, rather, a role designated for her by New Tech staff, since the actual director was so difficult to communicate with. This teacher had been at School 3 for 15 years, and she had seen the school's transition from the pride of the community (with a winning basketball team) to the scourge of the area, with student population falling from over a thousand students a decade ago to 300. She "worked for four superintendents and at least eight principals" in her tenure before New Tech. She said that the superintendent brought in New

Tech with little explanation to, or discussion with, the staff. Describing what it was like when she first heard that the superintendent had contracted with New Tech, she remembered:

> It was just "this is what we are going to be." […] We needed to either shut down and reopen as something else, transition, remove your staff, hire new people, or transform. And probably the least invasive thing to do is transform. So he brought that in as a model – as our transformation model. I mean, we couldn't really say "no."

As she described, teachers were not recruited into the program because of interest; all teachers in the building were forced into the New Tech model by year 2 of implementation. Neither the superintendent nor the then director was interested in cultivating teacher buy-in or support. School 3 was the school in our study most in need of school improvement according to quantitative measures of student learning, and the district looked to New Tech to provide a model for that improvement.

Despite the external pressures to improve the school, there were some internal motivations for why New Tech was chosen as the external provider for School 3's improvement plan. A veteran science teacher at School 3 believed that the superintendent's own experience as a poor student made him more interested in models that were flexible to students who have not been successful in traditional schooling environments. In some ways, his description echoed what we heard from the superintendent in District 1: "[The superintendent] must have not done well in school himself. And so he did not like anything that looked like a traditional classroom. […] He just saw this open - what he called an open concept." So the superintendent, inspired by what he interpreted to be New Tech's core component – an open concept – adopted the program in the hopes that it would change the trajectory of School 3's performance.

A humanities teacher and New Tech Advocate at School 3 described how project-based learning allowed her to approach students differently. She could tell her students: “Hey I don't need to teach you this, figure it out. And if you don't understand it, then come back to me and we'll have a workshop.” She said that this was “new because it was stepping away. Because at the same time too, we'd been very used to coddling the kids here.”

The pseudo interim director of School 3 described what she thought of project-design this way:

> I think it was just really trying to think of real-world problems. That was a difference, just thinking about what sort of problem that would engage a [student] instead of thinking, “Oh, I like this” or just doing something because it was fun. The fun can be an engaging part as long as it supports the standard. Now I am thinking, “How does it support the standard? How can it be rigorous? What kind of technology can I put in there?” I guess I am taking it a little more seriously.

Like some of the teachers in School 2, she used questions to help her explain the model’s core components. She and other teachers, though, described the confusion they encountered when they could not answer one of their own questions. They sought guidance from Emily, who often simply asked more questions. Because of this, some teachers in this study seemed to have a cursory understanding of the project-based learning model New Tech promoted. After a year teaching at School 3 under the New Tech program, a humanities teacher – and the New Tech Advocate – said, “Project-based learning is, in my own words, it is taking a concept and creating an end project. It is that. Because […] your finished project is going to encompass many learning outcomes, as opposed to just one.” Other teachers described project design almost entirely in terms of the artifacts students would have to make to demonstrate their learning at the

culmination of the project period. This fixation on the end product left some teachers with little notion about how to fill in the gap of time between project roll out and project wrap up, which resulted in students being left to their own devices to use (and sometimes abuse) the technology and freedom given them.

A math teacher at School 3 described his initial impression of New Tech as being exclusively focused on technology. For this teacher, technology use was an essential component of the model:

> Well when I first started I thought they wanted me to just do everything off the computers. Everything was just "we're just going to work straight off the computers and kids are going to do this thing." It really gave me the sense that we're going to do everything from the computers. That's going to be our platform. And it was preached to me that there's no more pencils, no more books, and this and that.

But, he said there was disconnect between the promise of total technology integration and the reality at his school, where there were not enough computers for all students. "But then again they bought me a whole new set of books. So it's kind of curious." He described important differences in how he made sense of the New Tech model and what he was actually able to execute in practice. This perception-practice disconnect, in turn, influenced this teacher's perception of what was "core" in the New Tech model. While he initially felt that technology was core, his inability to take advantage of technology in his own classroom led him to fill in the gap with new ideas about core components. Later in one of our interviews, this teacher focused on the novelty and ambitiousness of the end products he had seen when visiting template schools within the network: "I was amazed at what the kids were doing. I mean they were building rockets; they were building hydrogen-powered lawnmowers and stuff like that." Without

evidence of his initial impression – that technology was core – this teacher fixated on the creativity of end products as being core to the model. His judgment of the quality of his own teaching, then, was redirected toward the quality of end products rather than technology use. This teacher's experience illustrated an important effect of varying interpretations of the core model components: teachers in the school measured their own success by any number of different yardsticks.

Similarly, a veteran science teacher at School 3 described school culture as central to his perception of the New Tech model, but he worried that his colleagues and administrators were not giving it enough attention:

> Our biggest problem is school culture. Every professional development we have should be dealing with school culture, I think. Because I think if you solve the culture problems, everything else falls into place. And we spend almost no time on that, and that's the most important thing.

This teacher believed that school culture was a core component of the New Tech model, and the way he understood the model was bound up in what he had seen and heard about school culture in template sites. But he struggled with understanding if it was essential when he did not see it emphasized in trainings, professional development, or leadership behaviors.

Influences on Interpretations

The preceding findings reveal the extent to which a single "model" for reform can be interpreted in myriad ways, with different implications for replication, adoption, and implementation. Three features among the hub, the model, the environments, and the schools stood out as most influential in creating variation in how actors interpreted the New Tech model through a sensemaking process:

1) the hub's open-ended organizational and coaching structure;

2) the model's reliance on over-simplified phrases to describe complex maneuvers; and

3) the disparate reasons for adoption within environments and schools.

The formalized core model, as documented in the materials and trainings of the New Tech hub organization, helped to establish certain words that were used to describe the model, but how and what it formalized seemed to heavily influence the core characteristics New Tech staffers communicated to outlets, and, in turn, what outlet-based actors interpreted as significant in the model. In particular, the structures of the hub organization and the nature of the reform type seemed to create unique strengths and vulnerabilities when it came to making sense of the model.

Open-endedness in the hub. There were common themes found among outlet-based actors, as well as some notable differences in how they interpreted the New Tech model. Across school sites, teachers were able to name many of the generic steps involved in project design, which were formalized in New Tech documents. Although most teachers truncated the process in one place or another, almost all of them referred to the steps in the process that were given unique language in formal documents: the know/need to know process; scaffolding; and the culminating presentation of a product. *How* teachers were meant to design these components was, again universally, never specified in language. This indicated that New Tech gave the components of projects precedence over the mechanisms required to enact project-based learning when considering how to formalize its core characteristics. The organizational structure and methods of coaching that New Tech employed – grounded in social processes without a strong hierarchical structure – seemed to be strongly connected to misalignment among actors' interpretations and the formalized model.

Because the coaching method allowed for – and privileged – different interpretations about what was important in the model, actors across school sites interpreted certain aspects of the model as having primacy over others. For the director at School 1, physical arrangements became central to his understanding of the model because they were what convinced him that the model could work for him. This interpretation preoccupied his understandings, even when getting his school off the ground, leading him to subjugate other, possibly more important, components of the model, such as a commitment to school culture-building activities. Similarly, when a veteran humanities teacher at School 2 became consumed with the notion that he should privilege "process over content," it became difficult for him to commit to the projects he had designed and see them through to the end. A math teacher at School 3, likewise, focused so much on his use of technology that he neglected to design relevant projects that would engage his students. Because each of these characteristics could be part of New Tech's core – and was communicated at some point through formal documents or templates – these outlet-based educators found themselves grappling with how to prioritize their understandings and actions.

The nature of the reform New Tech was attempting to replicate, with project-based learning as its instructional core, left the New Tech model vulnerable to varied interpretations as it was tested in diverse outlets. Because several formalized model components asked teachers to do things quite foreign to traditional school settings, most outlet-based actors had little to no experience with interpreting the messages they received about the core model. While New Tech formalized components related to the general steps teachers should take when designing projects and the technology they should use when implementing them, they left the execution of design and technology use in the hands of educators. This hands-off approach was, according to New Tech, a way of teaching outlet-based actors about what was "core," through application of the

model on their training experience. For some teachers, it was a useful format that allowed them the space to interpret the New Tech model within the universe of their previous proven teaching experiences. The lack of specification in design and execution, however, left many teachers, especially the least experienced, with wide latitude to interpret the model in disparate, sometimes conflicting, ways. Because so much about the model was foreign, outlet-based actors were forced to hinge their understandings of New Tech on particular characteristics that resonated with them personally. While most of those characteristics are referred to in formal New Tech documents or in New Tech staffers interpretations of the model to outlets, in isolation they served to muddy the core components of the model. This made it difficult for New Tech to systematically test components of the model in order to refine the formalized documentation of what was core and what was, perhaps, idiosyncratic or not uniformly important in the model's success.

Catch phrases. New Tech's heavy reliance on catch phrases to formalize its model made it somewhat easier for staffers and outlet-based actors to use a common language to describe their interpretations. Where there was agreement on meaning of those phrases, the common language allowed for ease of communication and a check on behavior when enacting the model. When there were disparate interpretations of the phrases, however, the common language actually seemed to make it more difficult for New Tech staffers and outlet-based actors to come to consensus about what was core and what was not.

For instance, one of the phrases that many outlet-based teachers adopted was related to how they should behave in their classrooms – not as "the sage on the stage," but, rather, as the "guide on the side." New Tech staffers described this phrase in terms of the way in which a teacher should lead class – with inquiry and probing, using routines like the "know/need to know process" and executing scaffolding activities to assist students on particular areas of content.

This was an ambitious request for most teachers, who were used to being in control of every dimension of classroom activity. The novelty of the phrase created an opportunity for varied interpretations of how to implement this model component. For some teachers, this phrase was seen as a warning to not lecture, not tell students what to do or what the right answers are, and to let students be completely in control of their own learning. They did not take the phrase to mean that they should be questioning and leading their students to learn standards-based content.

These different interpretations of core components of the New Tech model – inquiry, on the one hand, and passivity, on the other – had important implications for how teachers enacted the processes indicated by the catch phrases. Indeed, as explanation for why one teacher in School 3 did not intervene when her students misbehaved and were clearly not working on a project, she said that she was trying to be "the guide on the side," and allow her students the freedom to learn on their own. While Emily believed this teacher should have intervened, Emily herself was reluctant to step in because of her own interpretation of what was core in the New Tech model – the freedom to let teachers make their own decisions about how to enact project-based learning. Alternatively, at School 2, another teacher's interpretation of this same phrase led him to demonstrate traditional teaching practices for individual students, in conversations and lectures literally off to the side, while other students worked on projects. When his students misbehaved, he considered it his role to help diffuse problems, so that students could get back to the important project work he had planned. Differences in interpretation of a model's core components, therefore, had serious consequences for implementation and any consistent "treatment" that might be seen in New Tech schools.

Reasons for adoption. The initial reasons for adoption of New Tech also led to some differences in how actors in the three schools interpreted the model. The strongest and most

dedicated leadership in District 1 meant that actors in School 1 interpreted New Tech's formalized components more consistently and in closer alignment with New Tech staffers' interpretations of them. Teachers in School 1 more often identified New Tech core components as being related to project-based learning and project design.

Alternatively, in School 2, with a staff of mostly veteran educators, the "we'll try this out and see" attitude of leadership seemed to influence teachers' interpretation of the model as being heavily process-driven. Of major concern to most of the educators in the building was trying to balance their conceptions of how much content needed to be covered with their belief that New Tech was asking them to forego content in favor of process.

Finally, the lack of strong leadership in District 3, as well as the lack of infrastructure in place to support any sort of positive school culture, led School 3 educators to emphasize the core components of school culture and technology, two elements that were underdeveloped in School 3's implementation. At School 3, teachers' interpretations seemed to be heavily influenced by what they perceived as problems in their school. In their view, if New Tech was supposed to be the "answer" to their school performance problems, then the core components of the New Tech model must be direct solutions to those problems, such as a leadership void or school culture deficiencies.

Discussion

Previous research on hub-outlet school reform has suggested that the interventions of school reform organizations, as well as the interactions that bear out between those organizations and the environments, schools, and instructional models with which they work, are strongly related to the production of educational supports that promote instructional improvement. But emerging research has also revealed the ways in which a single reform model can be interpreted,

through an interactive sensemaking process, in distinct ways that complicate understanding a model's impact on schools.

Reformers, practitioners, and funders have previously relied on the treatment effects of a specific reform model, as replicated in unique sites, to determine whether continued adoption and investment are worthwhile endeavors. The preceding analysis suggests that the notion of replication is not a straightforward enterprise, in which hub-based staffers faithfully communicate a thoroughly codified model to willing outlet-based actors who interpret the model precisely as intended. In fact, a core "model" turns out to be a myth in practice, when the dynamic interpretations of various actors lead to a co-construction of the model based on myriad inputs, prior experiences, and current challenges.

As evidenced in this study, the various interpretations of the New Tech model described above have lead to a co-construction of the model that challenges attempts to study its impact on school performance. It was clear from the descriptions of both hub- and outlet-based actors that the formalized components of the New Tech model were not uniformly interpreted in outlets. Instead, actors in outlets were influenced by formal materials, language, prior experience, and school conditions so that their interpretations, codified only in their own practices, allowed for a unique co-construction of the model. Since this co-construction will vary depending on the actors in play, as well as the context in which they exist, the "core" model cannot be easily codified or, in the end, replicated.

Characteristics of New Tech, in particular, seemed to influence how and what was interpreted as core to the model. As a loosely structured organization, New Tech permitted experimentation and innovation, but the hub seemed to willingly sacrifice closely aligned understandings of many core components. For instance, New Tech staffers indicated in their

descriptions of the model that giving teachers the freedom to make their own decisions was an essential component of the core model. By giving this philosophical orientation primacy, they were reluctant to challenge outlet-based staffers' interpretations of how to conduct project-based learning design. As they made sense of the model by verbalizing their interpretations of it, outlet-based actors were allowed to drift significantly from formalized components, since the component of autonomy was emphasized so much by hub-based actors. Because New Tech had rapidly scaled up, with few templates and many outlets in diverse contexts, the organization was particularly susceptible to the range of outlet characteristics that had not been accounted for in formal materials. Because of this, what was "core" to one actor was often idiosyncratic or marginal to another.

Hub organizations can use these variations to more tightly hone their core models, bringing lessons from outlets back to the hub organization to refine and implement in templates. But the experimentation and learning phase of replication must be intentional. An organization that attempts to replicate at large scale without having experimented with variations on its core model will likely encounter problems in interpretation and implementation as more outlets come online. Understanding this phenomenon and preparing for it are necessary functions of a hub organization that hopes to adapt and formalize its model to ensure successful replication.

This iterative process has important implications for evaluators who seek treatment effects in impact evaluations. If "the model" is at once only partially realized, and if every new outlet tests out and informs core components of it, then evaluators must account for the co-constructed nature of the treatment when they seek evidence of its success. This study indicates that a qualitative investigation into precisely what is being enacted as "the model" could be useful in interpreting findings of impact analyses.

Conclusion

As more schools across the country consider working with external school reform organizations – and as more reformers devise models for improving schools – it is essential that researchers begin to synthesize evidence from the field about how models for reform are interpreted and play out in different school contexts. This study provides important evidence of the phenomena of sensemaking in the school reform replication process. Rather than adopting a school reform model wholesale, educators will interpret formal documents, messages from hub-based staffers, and verbal descriptions from other outlet-based actors to come to conclusions about the meaning of reform and what is expected of them. Hub organizations must prepare for these variable interpretations, guard against them when they are likely to seriously undermine the core reform, and make decisions about when to be flexible or strict in communicating core principles.

APPENDIX

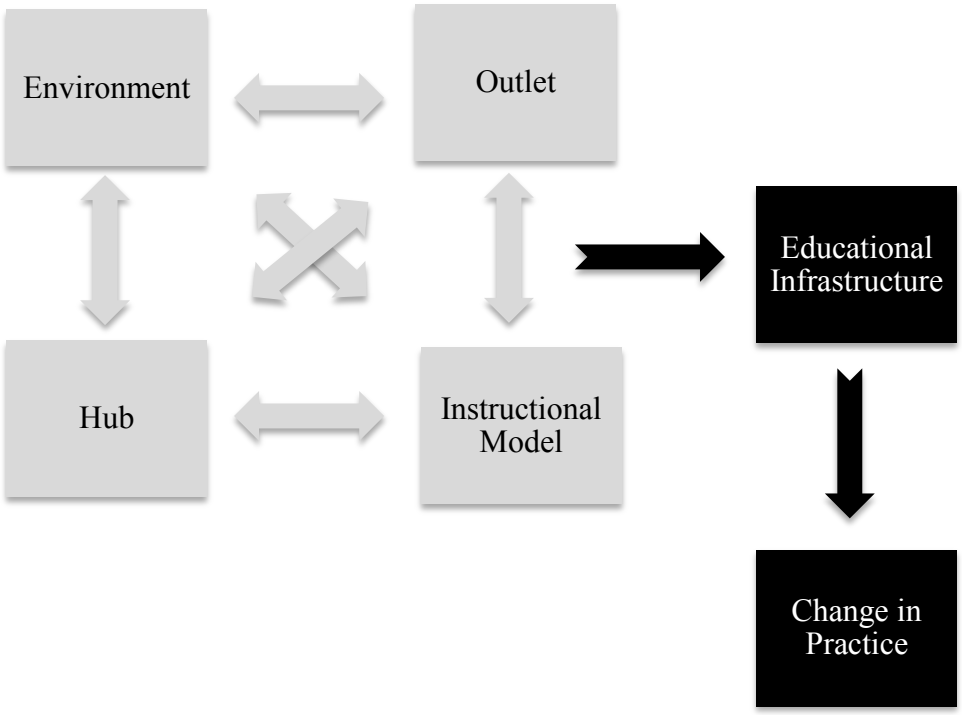

Figure 1. Organizational Dynamics of Hub-Outlet School Reform. This figure illustrates the actors involved in hub-outlet school reform and the result of their efforts. The grey components are the focus of this paper. Actors in environments, outlets, and hubs engage in interactive sensemaking activity that results in a co-constructed instructional model in practice.

Table 1
Descriptive Data on Three Michigan New Tech Schools, 2010

	School 1	School 2	School 3
Enrollment	231	99	300
% Minority	3	52	84
% FRL	16	60	78
Students/Teachers	23.1	19.8	24.5
Grades in Year 1	9, 10	8, 9	9, 10
Average Teacher Experience	8 years	17 years	Unavailable
Urbanicity	Midsize Suburb	Small City	Large Suburb
School Design	School within a school	New school	Whole-school conversion

1.Data were provided by school directors.

Table 2
Frequency of Codes Used to Analyze Interpretations of the New Tech Model

Code	Communicate with New Tech	Instructional Design	Design Changing or In Flux	Design Differentiation	New Tech Characteristic	New Tech Coaching	Coaching Changing or In Flux	Coaching Differentiation	New Tech Function	New Tech Growth	Growth Beyond Means	New Tech Lack of Capacity	New Tech Mission	New Tech Requirement	New Tech Structure	Principal Variability	Teacher Variability	Why New Tech	Totals
Communicate with New Tech					1	10													17
Instructional Design			3		11	5	1	1		1			1				2	5	96
Design Changing or In Flux		3		1	1	1	1												9
Design Differentiation			1									1				1			7
New Tech Characteristic	1	11	1			4			1	1			3		2			2	55
New Tech Coaching	10	5	1		4		4	1	3		1	3		1		1	1		82
Coaching Changing or In Flux		1	1			4				1		3							12
Coaching Differentiation		1				1													2
New Tech Function					1	3												1	12
New Tech Growth		1			1		1							1					8
Growth Beyond Means						1						3		4	1	1	1		18
New Tech Lack of Capacity				1		3	3				3					1	1		17
New Tech Mission		1			3														6
New Tech Requirement						1				1	4					1			12
New Tech Structure					2						1								9

Table 2 (cont'd)

Code	Communicate with New Tech	Instructional Design	Design Changing or In Flux	Design Differentiation	New Tech Characteristic	New Tech Coaching	Coaching Changing or In Flux	Coaching Differentiation	New Tech Function	New Tech Growth	Growth Beyond Means	New Tech Lack of Capacity	New Tech Mission	New Tech Requirement	New Tech Structure	Principal Variability	Teacher Variability	Why New Tech	Totals
Principal Variability				1		1					1	1		1					25
Teacher Variability		2				1					1	1							22
Why New Tech		5			2				1										16
Totals	17	96	9	7	55	82	12	2	12	8	18	17	6	12	9	25	22	16	

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CHAPTER 2

Conditions of Success in School Reform: An Infrastructure Analysis of the New Tech Network

The public education landscape has witnessed a huge increase in the amount and frequency of reform initiatives, interventions, turnaround plans, and other policy "action" since the passage of No Child Left Behind in 2001. Often, external education organizations bring about this action through contracts, partnerships, and policy development with schools or lawmakers. These organizations include charter school operators, for-profit educational vendors, and non-profit reform entities, many of which work in some of the most challenging school contexts in the country. In particular, the recent investments in federal School Improvement Grants has led to interest in "hub"-based organizations that offer pay-for-service models of reform to "outlet" schools that are looking to improve student outcomes in response to demands of state and federal accountability systems.

These organizations promote methods for supporting change in educational practice that, in turn, may improve student test scores and other outcomes. Demands for proof-of-concept studies of hubs and models make these entities ripe for investigation into what they have to offer schools, especially those with little internal capacity for improvement. In particular, interested funders and school-based personnel are likely to seek out models that have proven effectiveness in school improvement and turnaround, to ensure worthwhile investments in financially strapped environments. Given calls for evidence of success, research has focused on studying the "impact" of these organizations and their models on student outcomes, using randomized control studies and other statistical procedures to tease out the effects of a particular program.

And, yet, there is evidence that suggests that models for reform are not adopted wholesale in schools with varying resources, interests, and contexts. In fact, the features of both hubs and outlets can even affect the interpretation of models. When it comes to implementation, studies of school reform have long documented the variation that can occur across sites, based on educator capability, student population, and perceived need, among other features. Therefore, investigations into the impact of a particular reform can only be fully understood when considering the variables that affect how the model is implemented to support change in schools. Indeed, the infrastructure required to support substantive and sustainable change in practice is extensive even in the best of school contexts. This paper will analyze the features of hub organizations, reform models, educational environments, and outlets to understand the development of educational infrastructure to support school reform, illuminating the need for consideration of these features in understanding program "impact."

Literature Review

School improvement is a rapidly growing industry in American public education. Nonprofits, private companies, charter operators, and state-, district-, and school-based programs abound – each with models of reform that seek to support educators in changing practice for the benefit of student learning. Since the passage of No Child Left Behind in 2001, the focus of many of these reform programs has been on increasing student learning, as demonstrated through reading and math achievement tests. Federal and state accountability pressures have led to increased interest in programs that can move the needle of student achievement in all types of schools, and especially in those that serve historically marginalized populations, such as low-income students and children of color. But over a decade of work in this area has led to precious

few “proven” programs that, in all types of schooling situations, are able to transform educator practice to the degree that it drastically influences student learning.

There are many reasons why successful whole-school reform is difficult. The RAND Change Agent Study was one of the first projects to undermine the assumption that actors in outlets generally faithfully implemented reforms (Berman & McLaughlin, 1976). In fact, the authors found that, through an investigation of hundreds of programs, there were numerous factors that affected how and to what degree a reform was implemented as intended. Ultimately, they argued that reform in schools is implemented through a process of mutual adaptation, in which intended reforms are adapted through a joint process between reformers and school staff, based on individualized need within school sites. This process of adaptation poses considerable challenges to understanding program impact, since no one program is implemented in the same way across diverse sites.

Researchers from the Study of Instructional Improvement (SII) and the Consortium on Chicago School Research continued this line of work and documented the interdependent nature of the relationships between environments, schools, organizations, and models for improvement, within the process of mutual adaptation (Bryk, Sebring, Allensworth, Luppescu, & Easton, 2010; Cohen & Ball, 2007; Cohen, Ball, & Center, 1999; Glazer, 2009b; Peurach, Glazer, & Gates, 2004; Rowan, et al., 2004; Rowan & Miller, 2007). Recent analyses have revealed how these factors actually interact with and among each other as actors within them design models for, and attempt to enact change in, practice. Bryk et al. (2010, p. 45) write, “These social interactions are bounded by various rules, roles, and prevailing practices that, in combination with technical resources, constitute schools as formal organizations.” Formal school organizations, made up of

people, practices, and expectations, interact with external agencies and their designs for practice in attempts to produce infrastructure to support instructional change.

Glazer and Peurach (2011) created an analytic frame to help them make sense of this complex set of interactions. They posited that changes in school improvement organizations came out of environmental turbulence that characterized the nature of reform. By distinguishing the external organization from the environment, the authors were able to articulate a new way of understanding the work of instructional improvement. They found that the interdependencies between the school improvement network, "comprised of three key components – network providers, clients, and designs," and the environment played a role in how organizations developed their work (Glazer & Peurach, 2011, p. 5).

Peurach (2011), in his work on the school reform organization Success for All, illuminated the need for understanding the interdependent relationships between school structures, tools, and personnel. He found that, rather than leveraging resources to improve just instruction, just leadership, just curriculum or any other singular dimension of schooling, successful school improvement agencies cast a wide net over every aspect of schooling, influencing all dimensions while working toward a common goal. But the study also revealed how the demands of fulfilling an ambitious school improvement mission led to a complex web of solutions and challenges. Glazer (2009b), similarly, found that external school improvement organizations – "interveners" – grapple with these interdependencies as they decide to what extent their work will intervene in multiple levels of schooling. As they design and attempt to implement interventions at the classroom level, organizations discover that their work is affected by factors outside of the classroom, such as the school and the environmental context. While this understanding is sometimes made explicit in organizations' implementation models, research has

often neglected the importance of these dynamics. Figure 2 portrays an analytic frame that can help make sense of these dynamics and how they produce the conditions of school reform.

Spillane (2004) writes that "viewing the school district as a policymaking agency is important" – and that view is just as important when considering how the school (and its district) not only interpret but also *make* policy in the enactment of school reform (p. 5). Rather than simply implement what they are told, and rather than simply reject the policy mandates handed down to them, educators implement policy as they interpret it along with policy that they believe they must implement in order to achieve their goals. Because of these adaptive and interactive processes, research on impact of school reform models must first examine the extent to which models are implemented differently across outlets and the features that bring about particular variations in implementation of supports for educational infrastructure.

Educational Infrastructure

Educators, especially those seeking external support for school improvement, do not typically have access to the resources required to transform the technical core of teaching – instruction. Educational infrastructure, or common instruments of teaching, learning, and academic content, helps to coherently ground the implementation of reform, so that educators can successfully execute it (Cohen & Moffitt, 2009). Infrastructure is necessary to support change in instructional practice. Because schools are often structured in ways that require teachers to collect the materials of their practice on their own, without coherence across grades and subjects and without proper training for developing curriculum and instructional strategies, any change in practice will necessarily require specifications for materials, curriculum, and instructional strategies – the elements of education infrastructure. When districts partner with an external education organization, they expect that the organization has coordinated expertise to

provide teachers with the infrastructure that will make it easier to implement a common school reform model across sites and classrooms.

Essential elements of infrastructure are those that allow educators to alter practice in predictable ways – ways that are likely to have a positive impact on student learning even across diverse settings. These elements include common instructional instruments, such as curricula, diagnostic assessments, and teacher preparation grounded in the common curricula (Cohen & Moffitt, 2009). These instruments, in turn, allow educators to use a common language around teaching, learning, and academic content that helps to influence predictable – and common – changes in practice. The vast majority of schools, districts, and states in America do not have this kind of built-in infrastructure. Standards are typically set by states, but the content of the instruments described above are often created in single classrooms, with individual teachers creating unique, rather than common, instruments for their own use. One potential advantage of an external model for school improvement is the common instruments that model might provide teachers and school leaders.

But there is evidence that hub organizations committed to school reform do not consistently provide comprehensive support for educational infrastructure, and what they do provide is influenced by the organizational dynamics described above. Hubs have different approaches to specification and common instrument development. Some of them are highly developed and require educators to simply take the instruments "off the shelf." Others, conversely, provide sketches of instruments and rely on educators in school sites to fill in the gaps (Cohen & Ball, 2007). Sometimes this process is quite intentional – meant to allow particular schools to develop school-based common instruments that are most useful for them. In

others, the general sketches of instruments are the core of the model and are not intended to be elaborated in common ways, even within schools.

The variation among hub organizations in the extent to which their instruments are standardized makes the study of implementation that much more complicated, especially as these organizations scale-up to sometimes hundreds of diverse school sites. Indeed, the slow emergence of reform models into replicable enterprises that have proven success has led to questions about this type of reform as a practicable solution for improving schools (Peurach, Lenhoff, & Glazer, 2012). The difficulty of bringing about new supports for instructional improvement makes infrastructure development an essential part of any school reform organization and model. How and in what ways infrastructure is implemented – and the causes of variation in implementation – has bearing on what impact can be discerned from a particular model.

Research Questions

The aim of this paper is to conceptualize and understand external supports for educational infrastructure in different school contexts. It describes the environmental and school-specific contexts of multiple school outlets, noting how the work of a hub organization is developed among interdependent relationships between its model for improvement, its outlets, and the environments in which it operates. It explores the complexity of bringing about educational infrastructure in environments where little existed before, beginning to answer the following questions:

- How does the hub organization design and implement supports for educational infrastructure?

- What features of outlets, models, environments, and hubs explain variation in the establishment of common educational infrastructure to support reform across sites?

Methods

In the tradition of Yin (2009), this study applies an exploratory case study approach to questions of how and why a hub-sponsored school reform model is implemented differently across outlet sites. As events occurred simultaneously to interpretation and analysis, this type of qualitative research is sensitive to the changing dynamics of organizations and human participants. In the following sections, I describe the hub-organization case and outlet sites that were the focus of this study, as well as the data that were collected and how they were interpreted to draw findings and conclusions.

Case

The New Tech Network (hereafter New Tech) is a national school improvement organization that began with one high school in 1996 in Napa, California. It has scaled up to almost 100 schools in the last decade and a half, with broad philanthropic investments (most notably a $6 million Gates grant) and acquisition by a large education enterprise called Knowledge Works. New Tech's model for school reform is founded on the principles of project-based learning and includes a model for collaborative school culture based on "trust, respect, and responsibility" and technology integration, including a requirement of one-to-one computing for every student.

New Tech is an ideal candidate for an investigation into how school reform organizations design and execute models for educational infrastructure and how features within and outside the hub affect variations on that infrastructure in outlet sites. As it has grown, it has significantly broadened the type and conditions of the schools it works with. Rather than limiting its reach

into particular school configurations, like schools within a school, or schools with particular capabilities or proclivities, such as those with a STEM focus, New Tech has established sites in all kinds of educational environments. This broad reach played out in the first Michigan cohort of six New Tech schools in 2010: two were whole-school conversions, two were newly established schools, and two were schools-within-schools. By implementing its model in dissimilar outlets without formal attempts to vary its model, New Tech is a prime candidate for understanding how variations among environments and outlets, in particular, influence the implementation of a school reform model.

The data collection and analysis for this paper was conducted as part of a broader two-year study into New Tech implementation in three Michigan schools. School sites were purposefully selected to represent three variations in type, in order to gather data on how New Tech is implemented in different contexts. School 1, a school-within-a-school, was an early New Tech-adopter. It is located outside of a large metropolitan area in southeast Michigan – its principal calls it "suburbal," part suburban and part rural – and its students are predominantly white, with only 16% who qualify for free or reduced lunch.[1] School 2, a new school site in a small city in western Michigan, is the most diverse of the three sites, at 48% white with a mix of African American and Latino students. 60% of students at School 2 qualify for free or reduced price lunch. School 3, which adopted New Tech as part of its turnaround proposal to win a federal school improvement grant in 2010, is 84% African American and 78% low-income.

Data

Over the two-year study period, qualitative data were collected from multiple sources in order to establish the most accurate portrait of implementation, behavior, and interpretation. The

[1] All school demographic data were provided by school principals in 2010.

study began with observations of the summer 2010 New Schools training, during which I took extensive notes during more than 15 hours of workshops, lectures, and school team meetings in Indianapolis, Indiana. Then, over the 2010-2011 and 2011-2012 school years, I observed five to ten staggered days of instruction, coach-facilitated meetings, and student behavior in each of the three school sites. Each of these observations included a faculty meeting, classroom practice, and coach-led one-on-one meetings with teachers. In addition, I observed classroom practice of three teachers in each building before and after interviewing them. All observations were participant observations, in which I responded when addressed and offered some limited thoughts on what I had observed.

I also interviewed school leaders in all three buildings and the superintendents of two buildings. The superintendent of School 3 was dismissed during the course of this study and did not participate in interviews. Each interview was recorded and transcribed, and informal conversations with interviewees were used to check understandings and accuracy of the interviews. In addition to school-based observations and interviews, I conducted three interviews with the New Tech school development coach, who was responsible for all three schools in the study, and I interviewed two intermediate school district officials who were instrumental in bringing New Tech to Michigan. Finally, I participated in and wrote observational notes on six director's meetings, which were facilitated by the intermediate school district officials and were attended by the principals of the Michigan New Tech schools.

In addition to observational and interview data, I collected formal written documents from New Tech trainings and the New Tech web portal, Echo. I also observed the New Schools trainings from 2010 and 2011 and took notes on the formal content presented, as well as the informal conversations between outlet and hub staff. New Tech agreed to participate in this study

and signed consent forms to give us access to materials and trainings. School district superintendents and building principals signed consent forms to allow access to all classrooms and faculty gatherings. All quoted participants agreed to be interviewed and have their classroom practice and school participation observed.

For each teacher interviewed for this study, I formally observed teaching practice at least three times – once in the first half of the 2010-2011 school year and twice in the second semester. I was able to document classroom artifacts, lessons, evidence of student learning, and project objectives. I used these observations as discussion points in semi-structured interviews. All first interviews were conducted face-to-face, either in person or via Skype video chat. I conducted semi-structured formal interviews with the three teachers in each school, New Tech superintendents, directors, and two intermediate district coordinators. Follow-up interviews with the school development coach and one of the intermediate district coordinators were conducted in person. Follow-up interviews and correspondence with other subjects were conducted via email or Skype.

I used Dedoose qualitative research software to analyze interview transcripts and observation notes. I designed a set of codes based on the analytic framework described above, and I coded excerpts of each written document based on those codes. In addition, I reread documents to determine themes that were missing in the codes already created. I then established new codes and reread documents, coding for new themes that had emerged. The software allowed me to aggregate the codes and determine patterns that emerged in the story of New Tech implementation. See Table 3 for a description of the codes used for this analysis, their frequency in my documents, and the patterns that emerged among the codes.

Findings

Schools and districts contract with external agencies for many reasons – there might be a particular need for professional development; students may not be reaching achievement standards; or community members may perceive deficiencies in current schooling options, as a few examples. The same organization may have different appeal for different communities. The decision about *which* agency to choose can be a happenstance endeavor, influenced by stakeholder interest, interpersonal connections, and financial considerations. Sometimes, schools do not realize a need for contracting with an external agency until they become interested in one that compels them. In the case of the schools in this study, there were some common reasons for contracting with New Tech and some reasons wholly unique to particular school needs. Across all school sites, though, teachers and school leaders expressed the sentiment that New Tech offered the promise of school transformation that would benefit students and could be adopted by diverse members of each school community. As an organization committed to reinventing the American high school and giving students opportunities to learn useful, applicable skills, the New Tech Network and its model for reform was very appealing.

The reasons why districts chose to partner with New Tech and the ways in which New Tech selected districts influenced the implementation of the model in Michigan throughout this study. Environments, outlets, and its own model and organizational structure, as well as the interactions that occurred among those dimensions, contributed to the variation I observed in the common implementation of supports for infrastructure. These interactions and influences help to illuminate the complex work of implementing school reform. I was able to document the organizational processes that influenced the kinds of supports offered to schools, as well as the ways in which those supports were influenced by environmental, programmatic, and school factors.

I report my findings in three sections. First, I describe the types of supports for educational infrastructure that New Tech provided its outlet schools. Then, I examine variation in implementation of this infrastructure along several dimensions. Finally, I apply the analytic framework described above to bring to light those features of the hub, the model, the environments, and the outlets that influenced variation in New Tech's supports for infrastructure.

Hub-Provided Supports

New Tech described its model as built on three primary components – project-based learning that engages students; technology that enables learning; and school culture that empowers students to learn (New Tech internal documents, website, 2012). The organization developed instruments that were intended to support educators in implementing these three model components across school sites: 1) supports for project-based instructional practice; 2) supports for technology usage; and 3) supports for developing school culture. The first two sets of supports were geared toward classroom teachers in New Tech schools, while the third set of supports provided instruments for both teachers and school principals, or "directors." New Tech intended for most of these supports to be commonly implemented, but some were intentionally left open to outlet variation. I gathered evidence on these supports through collection of formal New Tech documents and training materials; observations of coaching sessions; and interviews with New Tech and outlet staff.

Supports for project-based learning. Most of New Tech's formal supports for educational infrastructure were intended to help educators implement project-based learning methods. Project-based learning is an instructional approach that requires teachers to design lengthy theme-based project sequences, in which students with specified roles work in groups to learn content as they produce an end product that they present to an audience. Project-based

learning, as the central tenet in the New Tech model, represented a major departure from typical practice in American schools. The idea was that students would gain necessary critical thinking, communication, and other skills by working in teams to answer a question or solve a problem and presenting their work to an interested audience.

An example from a project that New Tech indicated was "exemplary" was called "Destruction and Construction," designed around the question, "How can we refurbish used computers so that they are useful and functional again?" The end product for this project was a refurbished computer that was donation-ready. In this project, students were meant to learn the following skills as part of a Computer Applications elective course:

1) Computer hardware names and specification standards.

2) How to take apart and put together a computer.

3) How to determine if a part is worth keeping.

4) How to replace broken parts.

5) How to install Operating Systems and software.

6) How to write the specifications of a computer.

While many of the listed skills are those that students may be expected to learn in other high school computer courses, New Tech students would learn them over four weeks by experimenting in teams, modeling their work after a brief demonstration by their teacher, and writing a specification report on the process. They would also be expected to learn skills related to at least one of their schoolwide learning objectives – in this case, written communication. And, instead of assessing students' skills using a traditional test, the teacher would use a set of rubrics to gauge students' understanding of content and process, as based on their interim work and on their final finished products.

Project-based learning is novel work for both students and teachers, who are used to teacher-centered, fact-based instruction with little room for experimentation or independent student discovery. New Tech's project-based learning methods required teachers to do most of their active practice in the project design phase – creating the theme, scaffolding activities, and criteria for an end product that would demonstrate what students have learned. This required teachers, who typically do most of their active practice in front of students – lecturing, experimenting, or leading activities from the front of the classroom – to change both the nature and pacing of their work in substantial ways. New Tech also asked that many of a school's courses be integrated, so that teachers team-teach larger classes with combined subject areas, such as biology and literature or geometry and physics. Almost none of the teachers in New Tech schools had prior experience with project-based learning, so New Tech spent the vast majority of its training resources on trying to support these practices in its school sites.

New Tech provided several formal resources to support teachers in enacting project-based learning. These included written documents to support the design of projects and an online web platform to house project resources and discover new project ideas, which is where the "Destruction and Construction" project was highlighted. One of the chief written resources that supported teachers was called a "project planning form," which asked teachers a series of questions intended to help them design a project. This template was to be used for all teachers, no matter the subject or grade level they taught. It began with questions related to what the teacher wanted to teach, for example:

- What content standards would you like to cover with this unit? Are their (sic) other standards that might fit well with this topic?

- In what ways could students demonstrate that they have mastered the skills and knowledge listed above?
- What 21st Century skills or schoolwide learning outcomes do you want to focus on in this unit?
- How could you evaluate a student's performance on the 21st Century skills you listed above. (New Tech internal document, 2010)

The next phase of the form asked teachers to think about real-world activities related to the content being taught, including a scenario that would allow students to learn the objectives selected by the teacher from state standards and from 21st Century-based schoolwide learning outcomes. Teachers were then asked to write down a driving question that would anchor the project in an authentic problem intended to spark students' curiosity and require standards-based content to solve. The next steps included planning assessments with rubrics for each component; mapping out what each day of the project would look like; thinking of scaffolding activities to support student learning (e.g., lectures, websites, textbooks); and developing processes that would help students enact the project. New Tech provided teachers with sample rubrics, project planning calendar templates, and several formalized processes that they could use with students, such as a "know/need to know" activity or a fishbowl exercise, in which most of the classroom would sit in a large circle to observe a small group of students while they worked through a problem together.

The format of the project planning form, with a series of questions posed to solicit responses that would help teachers create projects, paralleled the approach taken by New Tech coaches when working with teachers. Using cognitive coaching strategies, coaches asked guiding

questions rather than provided scripted or formalized supports for implementation. In this way, teachers were meant to learn through observation how they might transform their practice from teacher-focused to student-focused, where they served as a facilitator of learning rather than an arbiter of it.

Beyond the common project planning template, New Tech also provided teachers with access to an online portal called Echo, which housed a library of teacher-designed projects that teachers could comb through, including projects New Tech deemed "exemplary." While this library was not a common curriculum, it allowed teachers to take advantage of the design work of their colleagues, rather than start from scratch every time they embarked on planning a new project. Teachers could log on and search for projects that teachers in other New Tech classrooms had already designed. They could search by subject or keywords to find projects related to many required content objectives. Teachers were able to copy a project into their own courses on Echo and use it as-is or tweak it to fit their unique classroom contexts or subject matter.

New Tech's coaching model for teachers was also focused primarily on helping teachers through project design. A school development coach worked with each school and served as a resource for teachers when they had questions about creating new projects. Teachers were encouraged to reach out to their coaches through email, phone, and video chat. When coaches visited schools (about once per month in the first year and bimonthly in subsequent years), they spent time with most teachers, asking them questions about how project design was going and using the cognitive coaching inquiry approach to determine whether teachers were designing projects in ways consistent with New Tech's vision of project-based learning. Their questions were geared toward encouraging teachers to use the project template to support project design.

New Tech's supports to develop directors to be instructional leaders – an essential component of the New Tech instructional and school culture approach – were comparatively limited, existing primarily of rubrics that described practice, rather than strategies for how to build capabilities to enact high quality school leadership within the New Tech program. Emily, the New Tech school development coach who worked with each of the three schools in this study, discussed how the New Tech coaches had gaps in their knowledge of how to work with directors, because of lack of experience: "We have all been teachers; none of us have ever been directors." New Tech directors experienced two days of professional development throughout the year, and they had access to the school development coach to engage in discussions about implementation, but infrastructure to support the the practice of directors was under-developed.

The main formal support used to aide in the development of instructional leadership with common "New Tech" dimensions was a rubric that could be used to assess directors' practice. This rubric focused on the typical work of high school principals in traditional schools – staff recruitment and hiring; establishing goals and a mission; establishing a positive culture; developing a feedback and discipline system; effective partnering and advocacy; and financial and logistical management. After listing these rubric components during one of our interviews, Emily stopped to consider what was missing. She said, "As you can see, there is not really an instructional component." She suggested that this was a gap in New Tech's model that the organization was working on filling. In the interim, however, she said that she saw directors struggle with supporting teachers' instructional changes, but she did not have clear strategies for how to help them.

The resources described above were meant to create environments that would support the implementation of project-based learning in contexts where average practice was quite different

in type and pacing. New Tech was explicit about not wanting to create cookie-cutter schools, where there was a common scripted curriculum that all the network high schools would use. Instead, instructional methods were meant to be common, with content varying based on context. New Tech indicated that this ability to differentiate was necessary for engaging students in relevant content that they want to learn. So, while content across school sites could vary drastically, the processes used to deliver that content were intended to be common.

Supports for technology usage. The second major component of New Tech's model was "technology that engages." New Tech wanted all students to have regular and virtually unrestricted access to web resources, computer applications, and, in particular, the organization's web-based learning platform, Echo. New Tech's supports for technology usage included a requirement that all New Tech schools provide enough computers (usually laptops) for all students to use their own computer in every classroom. As part of each school's contract, New Tech gave them access to Echo and web support for the platform. Teachers were also trained to use Echo as a project management tool in their classrooms, so that any documents related to projects would be housed in the Echo project briefcases connected to their courses.

In most New Tech schools, each student was given possession of their own laptop, which they could take home and use for all classes. In some schools, especially those with limited funding for the New Tech program, students checked out laptops in each class and returned them at the end of the period. The use of this personalized technology was intended to enable students to more easily learn without the explicit direction of a teacher. Students could research on the web, but they could also use a host of applications to learn content and create their end products. Although New Tech did not purchase the computer hardware for schools, nor was it included as part of a New Tech contract, the organization did monitor the purchase of computer equipment

before the beginning of New Tech implementation. If needed, New Tech helped schools raise funds to purchase computers, either through community outreach or external grants. Then, once computers were secured, New Tech trained school-based technology directors to manage the technology, including how to troubleshoot problems with Echo. Most of this training was conducted at the New Schools conference the summer before schools opened.

New Tech also provided ongoing tech support for Echo, and coaches helped teachers and students learn how to navigate the platform during site visits. Beyond the project library, Echo allowed teachers to upload agendas, resources, questions, and tasks for students to complete. Students were able to log on at home or at school to access information on class projects in the interactive project briefcase. This forum included anything the teacher uploaded into the project, including the "driving question," a rubric the teacher could use to assess the quality of the final product, benchmarks to track progress, workshops, and additional project resources. New Tech encouraged teachers to use Echo daily, so that students would get into the routine of logging on to find the day's agenda, get answers to questions, and learn what they missed when they were absent. Since all New Tech classrooms should have this routine, the intent was that Echo itself would become a common element of infrastructure that could support both technology usage and project-based learning.

As part of her coaching support to schools, Emily regularly checked teachers' courses on Echo to ensure that they were implementing technology appropriately. When she found missing daily agendas or nothing in their project briefcases, she would bring this up in in-person meetings and try to understand why they were not using Echo to its fullest capacity. If teachers had technical problems or did not know how to use certain tools, Emily would help them or contact the national office to facilitate tech support.

Many teachers relied on New Tech's national tech support to support them through problems in using the technology. A teacher in School 2 said that he "emailed them fairly often" about Echo, especially when he had difficulty figuring out how to do something he wanted to do or when he noticed hiccups in design. By having an accessible national support team, New Tech could create a common support experience for all teachers across sites, diminishing the variations in usage of Echo, in particular.

Supports for school culture. Underpinning New Tech's supports for infrastructure was a philosophy of individual autonomy, which New Tech enacted by guiding and suggesting – rather than directing – specific behavior the organization hoped would lead to more complete implementation in each site. New Tech's supports for school culture were intended to foster this kind of philosophy across schools, so they were focused on building "trust, respect, and responsibility" among students and staff. To do this, New Tech formalized training processes for schools staffs that helped them make decisions together and learn from each other. New Tech used the language of Critical Friends protocols to describe how these processes were supposed to work. Participants were asked to share their "I likes," or the things that they liked about whatever was being presented; their "I wonders," or the things they had questions about; and "next steps" for moving thinking forward. This process was formalized in New Tech documents and was also encouraged by New Tech coaches during site visits and faculty meetings.

New Tech employed Critical Friends protocols to help coaches wrestle with tough problems and, in turn, coaches taught school leaders to enact Critical Friends protocols for their staffs. These protocols gave coaches and teachers a chance to voice questions, reveal strengths, and crystallize understanding about next steps – in project design or in supporting teacher learning. Because New Tech coaches were taught to employ cognitive coaching strategies by

learning the New Tech model through the same inquiry-based approach, they were comfortable with ambiguity and allowing New Tech staffs to make decisions on their own.

New Tech's supports for implementing changes in school culture included a range of protocols and norming activities that coaches helped schools devise and then held them accountable for fulfilling. New Tech guaranteed unlimited phone and email support for directors and teachers on all aspects of implementing the model. In each school in this study, the school development coach conducted seven on-site trainings in year 1 of implementation, which included coach-led staff meetings, one-on-one meetings with teachers, and a director training and debrief. Supports for school culture often arose during these coach-led staff meetings. For instance, in Emily's first meeting with School 1, she led a process through which the staff devised a consensus protocol that would help them make decisions. Throughout implementation, Emily reminded the school of their protocol when she ascertained that they were not following it, but she refrained from instituting rules or norms that school staffs had not agreed to.

Similarly, during New Schools training, each school staff was guided by a school development coach to decide on a set of schoolwide learning outcomes that all students would be held accountable for learning – and all teachers would be held accountable for teaching. Rather than traditional content objectives or state standards, these were outcomes that the schools decided all students needed to have before they graduated. Through the guided establishment of these outcomes – most of which were ultimately derived from New Tech-recommended texts on 21st Century skills, New Tech supported staffs in learning to work together and develop consensus about schoolwide issues. This consensus-building process was one in which New Tech staffs were asked to engage when other problems arose during the year. It was meant to

establish a school culture among the teachers and director that would lead to trust, respect, and responsibility among faculty, and, in turn, among students.

Variation in Supports

Through observations, interviews, and collection of formal documents, I determined that the supports described above were used by New Tech to help support implementation. They were meant to create common understandings about the New Tech model and to establish common practices, especially around instruction, technology usage, and school culture. But, through my observations and conversations with outlet-based staff, I learned that these supports were not all commonly provided to schools and many were not commonly implemented. In this section, I explore how these supports varied across and within outlets, both in degree and in type.

Variations in instructional supports. New Tech's supports for implementing project-based learning in diverse schools were first introduced in consistent ways across sites. At New Schools training the summer before the schools opened, a group of teachers from each school site participated in workshops, culture-building activities, and project design opportunities. While they worked within their chosen team teaching partnerships, they also interacted with teachers from across the network, all of whom were working on designing their first projects to roll out once school began. The process being taught was the same for most teachers at this time – they were given the project planning form and instructed to begin with the standards they wanted students to learn to build a project from the ground up.

At this point, teachers were not taught how to use the project library to support project development, with led to variations once teachers were back in their home districts. Instead of introducing teachers to the project library and having them select a project that they could tweak for their own classrooms, teachers were given little direction about how they might go about that

process. Because they were introduced to project-based learning by being asked to design their own, completely original projects, tweaking existing projects was foreign to them. Teachers were not able to universally take advantage of the project library as a tool that would help establish educational infrastructure.

Even among those school staff members who used the project library, however, there were variations in the extent to which it could support project development. School directors and teachers complained that, when they searched the project library, they were dissatisfied with what they found. Too often projects were so oriented toward a particular context that they would be unworkable in a different setting. In a director's meeting in the second year of implementation, several directors described how their teachers felt that the project library was a "joke." When they talked about collaborating on designing projects, several potential roadblocks were raised: differences in subject partnerships (some schools teach Biology and Literature together, for instance, while some pair Literature with History); limited time and resources to devote to cross-school planning; and concerns about school autonomy and the need to craft tailored projects that suited the needs of students in a particular school. So, while New Tech's support for infrastructure in the form of the collection and promotion of projects in the project library allowed teachers to garner ideas for designing projects in their classrooms, this support and its value varied based on the class configurations of each school.

For teachers who struggled with designing projects, Emily was there to support them in coming up with kernels of ideas or in writing rubrics to assess the final products. The bulk of the design work, however, was left up to teachers to do on their own. New Tech's project library was not robust enough to support the bulk of project design. Emily said, "Our project library gets blown up as something bigger than it is, unfortunately." She described how she would encourage

teachers to comb the project library to seek out projects that would fit their standards, but she recognized that the reality of the library did not live up the promise:

> Is the library as great as people make it out to be - maybe it's our marketing people. [Our] regional director talking about how we have millions of projects in there, when we really don't. We've probably got like a thousand or maybe less. Actually, it probably is less; like 500 of something like that. But anyway, we do encourage not re-inventing the wheel.

A check of Echo on August 8, 2012, revealed that there were 764 total projects in the project library, with 159 identified by New Tech staff as "exemplary projects." The limitations of this support meant that teachers actually did have to reinvent the wheel, using unfamiliar methods to plan for atypical practice in unusual classroom settings.

The directors in this study expressed generally favorable attitudes about Emily's coaching. They were grateful that Emily was a resource to them when they had questions. As Jeremy, the director at School 2, said:

> I use [Emily] for helping me in many ways. One is to ensure that we're on the right track. I use her as a thought partner. Here's what I'm thinking of doing, she knows our team, what do you think about this as an opportunity? Which has been very helpful. I also use her as a resource, too. How can I find X, Y or Z? Where would this be?

The director at School 1, had similar thoughts:

> I think [Emily] has been a huge support, like when I have questions. It can be 9:00 at night and I can send a text or an e-mail, or if I happen to see her online, you know just a quick chat on hey, I need some advice on this or that, and she's quick.

And the school leader at School 3 was the most impressed by Emily's help:

> She has been great. I don't think that New Tech would work without the support of the coach; I just think it would fall apart. It would be so much, so daunting. I think you would just go right back to your old ways. You really need that support with that. And she is great for—here is resources, here is ideas—she is great in the way that she helps you think.

When asked whether Emily's coaching helped directors feel as if they could be instructional leaders, however, the directors revealed that there was not specific training that made them feel as if they could "be Emily" when she was not there or when, after three years, they would not have New Tech coaching support anymore. School 1's director went on to say that he would like more help in figuring out how to support instructional change. He said, "How do I help some of my struggling teachers and how would [Emily] do it as a coach, so I could do it as a director? I have to have sustainability here in three years."

Supports to build infrastructure for instructional leadership often came in the form of suggestions or questions that were intended to help directors come to a conclusion about next steps. The director of School 1 described how, during one director's retreat, they were asked to read a book called *Shift: Secrets of Positive Change for Organizations and Their Leaders* by Janice Calnan. Directors discussed the book and lessons they could draw from it, and he brought some of those lessons back to his school the next week. New Tech relied heavily on passive interventions like this one – the organization provided the circumstances through which learning could occur, but it resisted specifying which lessons directors and teachers should draw in particular. Because of this, School 1's director was the only director in this study who benefitted from this particular support.

I did see evidence of learning and adapting within New Tech, based on the instructional needs coaches identified in schools. After the first year of this study, New Tech changed its coaching model to be more adaptive to school needs. Emily said, "We've changed our products and services to be more of a buffet, if you will, versus just one contract. So you can select to have additional coaching days based on your needs." This was a variation in supports that seemed helpful – the nature and type of supports would not necessarily change, but the frequency with which schools were exposed to the supports would, based on need (and on school resources to pay for them).

In addition, during the course of this study, New Tech adapted its model, coaching, and supports for math instruction. After several years of dissatisfying results on math student assessments, as well as complaints from math teachers that they were not able to teach the content they needed to, New Tech switched from a *project*-based learning orientation to a *problem*-based learning orientation for math. While many of the philosophical tenets behind project-based learning were still embedded in problem-based learning, teachers were allowed to design much shorter instructional units (a few days rather than a few weeks), spend a bit more time doing whole-class direct instruction, and focus slightly more on math content development than they had previously.

This change resulted in supports for instruction varying by subject matter for the first time in the New Tech program. Some math teachers were sent to California to experience problem-based learning training, and they were given resources such as modules from the Gates Foundation, to assist them in making this transition. But not all of the math teachers I observed were given or permitted to experience the retraining. As a mid-year switch, New Tech relied on schools' ability and willingness to allow teachers to be out of the classroom to relearn New Tech

instructional methods. Only one of the three schools allowed its math teachers to attend the California training, meaning that those math teachers were much more prepared to make this transition mid-year than teachers in other schools.

Variations in technology supports. Supports for technology usage in New Tech varied quite drastically from school to school, and even from teacher to teacher. One major variation was the degree to which teachers and students used Echo as a project management tool. While New Tech asked all teachers to house their projects and all related documents in Echo project briefcases, only some of them did this consistently. Emily would regularly check some teachers' Echo courses to ensure fidelity to this request, but she would not consistently do this with all teachers. She was especially reluctant to bring up problems in Echo usage with those teachers who were resistant to project-based learning. In fact, with some teachers, Echo usage was a major point of conversation and coaching inquiry, while, with others, it was completely ignored – as if there were bigger problems to deal with than whether the teacher and students were using Echo.

When Emily did monitor Echo usage, she used her reviews as a baseline filter to determine project-based learning implementation. She perceived the usage of Echo as an analog to project-based instructional methods, so teachers who regularly used it (in many cases, no matter what the content) were given more positive feedback about their instruction. This variation in feedback regarding Echo seemed to lead to even more variation in usage. When Emily discussed Echo with teachers, they would often bring up questions about how to use it more effectively, which led to more explicit coaching of Echo methods, tricks of the trade, and support from the national New Tech office. Teachers seemed more likely to contact New Tech's technical support team when Emily gave them additional context and information about Echo.

Another reason why the use of Echo varied significantly is that, throughout the study, it exhibited hiccups in its rollout and delivery. Many teachers found it to be riddled with inconsistencies, and they occasionally had trouble logging on and completing basic functions. Several teachers complained of instances when they had spent hours importing grades into Echo's grading system, only to have Echo freeze or crash, purging the new inputs. In addition, there were some teachers who perceived deficiencies in Echo's usefulness compared to other web-based tools they had used. The teachers who had used technology the most in the past, for instance, were often the first to suggest inadequacies in Echo's design, since their program of choice could do X, Y, or Z better than Echo could. For instance, a novice math teacher at School 1 said, in response to a question about the usefulness of Echo, "My major issue with Echo is it's not as reliable as other things, like Moodle. And it can't do assessment. The kids can't log in to Echo and take an assessment." He had gotten used to Moodle and other web-based tools that supported his instruction before New Tech, and it was difficult for him to understand why he had to use Echo, when it did not always serve his purposes.

Variations in culture supports. Through coaching and new schools training workshops organized around Critical Friends protocols, New Tech facilitated teacher-led processes through which school goals, routines, and expectations were developed. Because these processes relied heavily on staff participation, resulting decisions – when achieved – were often supported by the majority of staff members in the three schools observed. In particular, most teachers in all three schools eventually agreed to the schoolwide learning objectives that New Tech required each school to develop. But there was variation on the comfort the staffs had in embarking on this process. For the principal of School 2, the open-endedness of the process was unnerving – he said there was too much "choice" in deciding what the learning outcomes should be.

Alternatively, the principal in School 1 had come up with the idea of using a video by Tony Wagner, in which the author describes seven 21st Century skills, to guide his team's thinking (Wagner, 2010). In fact, when, Emily facilitated a discussion with the principal and teachers of School 1, they agreed to learning objectives that were very similar to those found in the video: critical thinking, work ethic, collaboration, written communication, oral communication, and technology. The open-endedness of the process, then, led to different implementation results that continued to impact other features of implementation throughout the study.

Throughout this study, New Tech's supports for environmental infrastructure emerged in two principle ways: 1) through the negotiation of financial resources to support opening and implementing New Tech schools, and 2) through trouble-shooting school-level problems in implementation. The first support occurred in all three schools I observed. A New Tech regional coordinator served as the initial point-of-contact between environments and the organization, establishing lines of communication, discussing contractual terms, and holding school districts accountable for meeting certain financial and implementation criteria. New Tech also requested and was approved by the state as an external service provider to School Improvement Grant awardees. In the community, New Tech staff members assisted schools in promoting their new campuses, participating in informational sessions for business and community members. Most of New Tech's supports for environmental infrastructure came at the district level.

In every instance in this study, district officials served as the initial entrance point for New Tech. New Tech worked with the superintendents to secure commitments and establish promises to adhere to formal "conditions for success," which were meant to be a baseline filter for schools coming into the network. New Tech did not consistently hold each school to all

conditions, though, so there was variation in the degree to which that formal support was useful in creating successful conditions.

The contract between districts and New Tech also specified the conditions under which the contract could be terminated. While optional termination could occur upon sixty days' written notice, New Tech also established the right to terminate the contract if the district did not ensure compliance with the New Tech model. In other words, New Tech held districts accountable for the faithful implementation of New Tech, not the other way around. This dynamic emerged strongly when problems arose in implementation. While problems of instructional fidelity to the model were typically dealt with at the school or classroom levels, problems of technical and cultural fidelity fell to the district. If technical or cultural problems arose, New Tech's school development coach would contact the New Tech regional coordinator, who would communicate with district representatives about necessary interventions. But not all infractions were treated equally, creating variation in intervention. For instance, a problem with School 1's director and his relationship with the other building leader led to numerous calls and meetings with New Tech representatives, who tried to ameliorate the tensions that had arisen. But a problem with School 3's toxic culture, wherein the principal was completely disengaged from instruction, led to no such high level interventions by New Tech. In the latter case, it appeared that New Tech was simply waiting it out until that principal left as planned the following year.

The dynamics of these interactions shifted during this study. Because coaches were nearest to implementation activity, they were typically responsible for communicating when district intervention might be necessary, but they were not responsible for enacting those interventions. In one instance, Emily contacted her regional coordinator to alert him to problems

at School 1. The New Tech regional coordinator then tried to "troubleshoot" with the district. He would take Emily's points into consideration, especially when she was able to say, "Here is the exact contractual issue that is being broken." She said, "My job is to raise red flags. [The regional coordinator's] job is to come take care of them." I saw this type of intervention play out for all three schools, but I also saw New Tech grow in its capacity to assist the district through coaching. Emily began to learn when it would make sense for her to intervene at the district level on New Tech's behalf, and how she might use her knowledge of what was happening in schools to inform supports at higher levels. This process was still evolving over the course of the second year of implementation.

Influences on Variation

In order for unique schools across diverse contexts to adopt the New Tech program with high fidelity, New Tech established supports that were intended to build the infrastructure needed to commonly implement the most important aspects of the model. From schools' perspectives, New Tech offered three major components in exchange for a three or four year contract: a project-based learning instructional model; a school culture model focused on developing 21st Century skills; and an integrated coaching schema with in-school support and professional development for the first three to four years of implementation. But, as documented above, the supports that would ensure common implementation of these components varied in the schools I observed. In this section, I explore the features of the New Tech organization and model, as well as the educational environment and individual school context that influenced the variation of these supports.

Conditions of success. Although certain conditions were asked of schools before they enter into a New Tech contract, there were few restrictions on the types of schools that were

accepted into the program. Therefore, the network consisted of high-performing schools that were producing many college-going graduates (i.e., School 1), middling schools in working class towns (i.e., School 2), as well as low-performing schools, some of which had qualified for federal school improvement grants in order to "turnaround" their failing performance, (i.e., School 3 and other prominent examples in the network). This willingness to work with many different types of schools made New Tech an attractive option, especially to those districts seeking external partners for grant-funded turnaround efforts. The support New Tech provided these different types of schools, however, was not systematically adapted based on school capacity or need. In fact, the organization used a formal common document called "conditions for success" to help it decipher whether to take on a new school. This form helped New Tech staff determine whether the baseline infrastructure was in place to ensure successful implementation of the New Tech model.

The conditions for success can be organized into two categories – "initial" conditions, or those that were required of New Tech schools before implementation, and "continuing" conditions, or those used to assess whether New Tech schools were implementing supports and practices with high fidelity to the formalized model. While New Tech did not explicitly differentiate between these conditions, it was clear that not all conditions were considered part of the initial screening process for entering schools. In fact, some conditions could not be assessed before implementation began. Initial conditions included those that were typically decided before a school opened, such as the maximum school size; the number and scale-up of particular grades; the unique identity of a school with its own code; the admissions policy; some technology supports; timing of staff hiring; and facilities design. Alternatively, continuing conditions were those that seemed to indicate that New Tech's infrastructure was taking root and the model was

being implemented as intended. These included: data sharing; instructional practices like Echo integration and project-based learning methods; partnerships with community, business, and higher education organizations; and staff assignments.

New Tech used the initial conditions of success to filter school applicants, through an informal process of discussions with district and building leaders. But, in each of the three school sites in this study, New Tech had committed to working with the school before all conditions were fully met. New Tech appeared to be satisfied with verbal commitments that schools would meet the demands of the initial conditions, and there was variation among the schools in the extent to which New Tech held them to these commitments. In all three of the schools in this study, at least one initial condition was not met in the first two years of New Tech implementation, meaning that the supports New Tech provided for schools would be implemented in uncommon settings with uncommon infrastructure – inconsistencies that resulted in lack of fidelity to the model.

School 3, for instance, struggled with 1:1 computing; creating a professional learning climate based on trust, respect, and responsibility; using project-based learning as the main mode of instruction; and creating physical learning spaces that supported team teaching and collaboration. Of particular concern for implementation was that there was not enough computers for all students. Teachers had to check out carts from which their students borrowed computers, but not every class could have a computer cart at once. When asked if there were supports that were missing that would help her in her instruction, a humanities teacher at School 3 said:

> Well, for sure the technology. We have 32 computers and at best we have 26, 27 that work at any given moment. They come in and then they crash—and 50-plus kids. […]

> Four people can't work around the same tiny notebook. So that is definitely where I feel unsupported, a missing link.

School 3's lack of complete technology infrastructure meant that, at any given time, many students within the school were unable to access the central organizational system of their instruction, housed in New Tech's Echo. While Echo was a core component of New Tech's supports for implementation, it ceased being a useful mechanism for ensuring high fidelity implementation when students and teachers had variable access to the necessary hardware. This lack of access to technology not only impeded the supports offered through Echo; it also inhibited teachers' access to the mostly digital coaching supports of the school development coach and students' abilities to guide their own learning through exploration of internet-based resources. New Tech's reluctance to stay firm in its requirement that all students have access to a computer in every class ensured that variation in use of technology was inevitable.

At School 3, I also documented some egregious examples of failing to create a professional learning climate based on trust, respect, and responsibility, which seemed to be related to inconsistent implementation of supports for school culture. During one coach-led staff meeting I observed at School 3, a teacher said that she wanted students to "act like human beings" and proceeded to call them curse words. In a debriefing session with a teaching team, a different teacher said that his students would not need oral presentation skills when they were working at McDonald's. In both instances, the New Tech coach, Emily, chose not to address the comments or discuss the professional culture of the school, in effect not intervening to ensure fidelity with one of the core "conditions of success." In addition, Emily did not employ the cognitive coaching strategies that New Tech promoted to support the school culture component of the model. Instead, she changed the subject and did not probe deeper into the issues at hand.

While School 3 evidenced the greatest number of infractions against the conditions of success, School 1 and School 2 also struggled to meet some of the basic entry standards for New Tech. Both schools continued to lack whole-school adoption of project-based learning as the primary instructional method, well into the second year of implementation. In each of my school site visits over two years, I documented at least one teacher in every school that, at the time of observation, had abandoned project-based learning methods in favor of traditional instructional techniques, such as class-long lectures, worksheets irrelevant to students' projects, or teacher-led discussions. None of these instances prompted school-level intervention on the part of Emily or her colleagues. These discrepancies were not viewed as school-level problems of implementation; rather, they were viewed as outlier individual problems that could be addressed through individual coaching techniques. But, even then, Emily's coaching was inconsistently implemented across school sites. There was much more communication, assistance, and training given to those teachers who asked for help or who seemed open to suggestion. But, as in the case of one science teacher at School 2, when teachers seemed reluctant or had not "bought into" the New Tech model, Emily was equally reluctant to work with them to ensure greater alignment with project-based learning methods.

At School 1, the struggle to create an autonomous unique identity within the larger comprehensive high school was an ongoing point of concern for the school director. He often wrestled with how to assert his autonomy to his former boss, the comprehensive high school principal. The principal would undermine his efforts to recruit teachers and acquire resources, and he would have to manage the dynamics of being in a building with two unique school staffs, one of which was skeptical and suspicious of New Tech. This is a common problem in school-within-a-school configurations, especially when a school is restructured to accommodate a

school within, rather than establishing multiple schools within the same building from the start (Raywid, 1996).

As an established problem of this type of school, it would seem appropriate for New Tech to devise interventions and supports that would help school directors manage the relationship between a New Tech school and the other school(s) within the building. In my observations, there were no such supports, and School 1's director negotiated these difficult dynamics largely on his own. While Emily was aware of the difficulties he had in creating an autonomous school-within-a-school, when asked about how she helped him negotiate those relationships, she said, "You see that is tough. It is actually a bit outside of my job description. My basic role is to be an advocate for the staff and the leadership of a New Tech school." By refusing to engage in strategies to support his experience in a school-within-a-school, New Tech varied one of the core elements of infrastructure that support the development of an empowering school culture. In addition, the director was so distracted by the recurring problems of his in-school dynamics that he neglected some of his New Tech responsibilities, such as monitoring instructional practices.

New Tech's own lack of infrastructure for ensuring implementation of all of its formal conditions of success led to observable differences in implementation. Indeed, the conditions became evidently important to New Tech school leaders, as they themselves were able to identify problems in implementation even in the midst of their first years. While Emily was the primary contact between the schools and the New Tech Network, her training to be a New Tech coach did not prepare her to support these high level conditions of success, especially comprehensively and simultaneously. Emily's efforts, when they were evident, did not affect change in policy or in attempts to meet the New Tech conditions. Other New Tech staff members

did not intervene to ensure fidelity, either, even when they were made aware of the implementation problems through outlet-based staff and through Emily.

New Tech – school dynamics. The New Tech hub organization included the staff, leadership, and organizational dynamics and decisions of the nonprofit New Tech Network. Certain decisions and characteristics of the hub itself influenced how some supports for infrastructure were implemented in the Michigan schools in this study. In particular, the ways in which the hub chose to support infrastructure development – and the variable school responses to that support – heavily influenced how and to what degree schools were able to build common practices in implementation.

New Tech promoted its primary model components to each school, but it also developed unique promotional arguments based on each unique school context. Throughout the promotion and scale-up of the organization, New Tech crafted its message about what it had to offer. For instance, at School 1, New Tech promoted its requirement that all students could earn college credits before graduation; at School 2, it was an opportunity to innovate practices that could be brought back to the local schools; at School 3, it advertised its success with students who would have dropped out of school in a traditional setting. As much as it was an educational organization, New Tech was also a rapidly growing enterprise with many employees and investors; the educational landscape had a competitive market of options for both educators and students, and New Tech demonstrated a desire to be a top-rated choice for schools.

The ways in which New Tech convinced schools to partner with the organization seemed to influence how supports were delivered and implemented throughout the study. For instance, in School 2, the director said New Tech was attractive to him because it seemed like the best cost-benefit ratio for experimentation with new instructional methods: “The thing that called out to

me was being able to, at the lowest possible cost, so to speak, for a student to learn the skills that they are going to need for the rest of their life." The hub seemed to encourage this perception, which caused some difficulties in implementation when supports required additional costs of time and money. In order for the school to fully implement the New Tech model, the director needed to learn how to lead a school culture focused on trust, respect, and responsibility. But the hub's ease at allowing its outlets to perceive the model in many different ways – and its willingness to allow coaches to decide when and how to support the development of school culture – also allowed this director to neglect this responsibility.

Given that enacting project-based learning is heavily knowledge-dependent, and that it is novel work for most teachers in the U.S. (Thomas, 2000), one would expect that New Tech would provide highly-developed, formalized, and codified resources to support teachers in project planning and instruction. However, while New Tech provided a codified project planning framework and Echo, it did not offer many formalized resources to help teachers develop the unique components of each project, including authentic scenarios, scaffolding activities, and pre-designed rubrics. It relied heavily on the use of Critical Friends protocols and cognitive coaching strategies to guide teachers toward solutions in their planning. Teachers and school leaders indicated that the resources available in Echo were often either poorly designed or so specialized that it would be difficult to adapt them for new classrooms.

In addition, New Tech did little to formalize disciplinary and background knowledge that would inform the work of developing projects. Without extensive background knowledge to guide teachers' thinking, teachers relied on their prior, often traditional, teaching experiences to respond to coaching strategies. When coaches were not there to ask questions that would guide teachers to reasonable answers, teachers struggled to come up with ideas for authentic projects

and found it difficult to extensively plan the multiple components required in the model. A science teacher at School 1 expressed the chaos she experienced when trying to plan and teach in the first year of implementation:

> This year all I could to do was stay ten minutes ahead of kids and I have no idea how the day is going to go and I have no idea about my timing and I have no idea about what they need for that project. And I feel just like I do not even recognize myself sometimes in front of the kids.

The limited formal resources for project design impeded the development of coherent and common instructional practices. Even the resources that were available, such as the project library, were suggested to teachers rather than required by New Tech. Instead of asking each teacher to choose a vetted project from the project library and tweak it for their classrooms, coaches "encouraged" the use of the project library, but even that was unsystematic. Emily said:

> We encourage looking at the project library and not re-inventing the wheel. In fact, I've told more than a few people that they should just take a project and use it and tweak it for their own use, for one of their first projects so that they get the feel for what we see as an exemplary project. So that they can experience it, implement it, and let it guide their own ideation from then on.

But the use of the project library was something Emily suggested only to some teachers, and not at particular times throughout the year. In addition, teachers, directors, and New Tech staff all expressed dissatisfaction in the quality of the project library as a strong resource that supported instruction.

And the cognitive coaching strategies that were used to supplement the formal resources often fell short of providing teachers what they needed to adopt common instructional practices.

The director at School 2 said, after participating in a meeting on project development with one of his teachers and Emily:

> I think the frustration that [we] had at the end of that discussion was that we were hoping for the knowledge of how to turn what we want to do into that kernel of a driving question that gets us where we want to be. And it didn't seem like we were able to get there. […] I think we can think of that as an area of improvement as a network. To overtly teach that. Because without a good driving question, you know your project is just content.

Staff members at School 2, in particular, were vocal about the lack of formal resources available to help them with project design. One echoed what I heard in several meetings with New Tech directors and teachers:

> If there was something, I don't know what it would be, but if there was something that could show us how to move from the content direction into the collaborative 21st Century direction, overtly or through a process of, maybe it's data, maybe it's videos, I don't know what it is. But if there was a way to help that earlier in the process, you might have gotten somewhere. We'd be further ahead then what we're at today.

Further, although New Tech did provide Critical Friends protocols, and supported teachers and leaders in learning how to use them, these activities were typically the only forum for collaborative assessment, evaluation, reflection, and adaptation of projects, which is exactly the sort of "design-based research" that is needed to improve projects to the point that they are effective (Blumenfeld, Fishman, Krajcik, Marx, & Soloway, 2000). These forums were not formally structured into the school day, so they typically only occurred during the few times a year the coach was at the school or when a leader asked staff members to participate. On these

occasions, the lack of background knowledge on how to enact projects often made reflection and ideas for adaptation rather shallow. There were not formalized processes with which to take what was learned during project enactment and what was discussed during Critical Friends to adapt a project for use in the future. Instead, once projects ended, they were rarely discussed again.

Because coaches themselves were taught through Critical Friends and cognitive coaching strategies, they too often lacked the background knowledge necessary to support teachers and leaders in unique situations. All of the New Tech coaches during this study were once New Tech teachers, but none were school leaders. Without formalized coaching materials, and without codified resources to support enactment of teacher and leader practice, the New Tech program was enacted quite differently from school to school, even in the foundational first two years.

New Tech coaches had limited access to the training for directors. Emily said that, in 2010, she was one of only four or five coaches that were invited to the leadership retreat, out of eleven coaches nationwide. Therefore, even though coaches were the staff members closest to the directors in implementation, they had cursory understandings of what precisely was expected from directors in New Tech schools. They could not always support them in determining appropriate strategies for instructional or cultural leadership. Emily described New Tech's bare-bones model for coaching directors in this way:

> Our expectation is that any time we're onsite we should debrief with the director at the end of the day. The first practical way of having that conversation is just putting it in their court, and I actually could do a better job of this, and just saying; what do you think is going well?

Like most of New Tech's supports, the coaching strategies for directors relied heavily on inquiry, rather than specified directions. Because it was often unclear to coaches and directors what their roles should be, though, the inquiry approach sometimes caused confusion about expectations.

One theme that emerged from my interviews with teachers and with Emily was that there was tension between what Emily believed teachers needed support on and what teachers sought support on. For instance, in January 2010, about halfway through the first Michigan New Tech school year, Emily said that "scaffolding and group dynamics right now are two of the biggest things" teachers need help on. And yet, when teachers sought Emily's support, they predominantly asked for assistance in coming up with project ideas or in translating state objectives to project content. Emily expressed concern with this disconnect. She said that teachers struggled with creating benchmarks and scaffolding activities to support student learning: "It's frustrating for me because they blame the students for not succeeding, but they haven't put enough support there to help them succeed." In turn, however, her coaching methods, based on New Tech's cognitive coaching strategies, often lacked the support that would help teachers succeed in project design and instructional implementation.

At School 2, for example, the principal – who had no instructional experience himself – filled in the gaps in New Tech's instructional model with beliefs that did not align well with New Tech's mission. He used staff meetings to criticize teachers for not collaborating enough, even while teachers struggled with designing relevant projects. As New Tech itself seemed to be learning, effective implementation relied on coordinated efforts to roll out model components. As new models emerge and develop in the school reform landscape, it is important to understand the costs and benefits of highly elaborated or unelaborated systems of support, and how the

sequence of delivery within those systems is related to high fidelity implementation. The director of School 2, said:

> So how can we as adults, because we're supposed to be the adults here, change what we do and practice and make it better. Because if you're not willing to look at how you do things and try and improve it, how can you expect a student to do that? We ask them everyday to collaborate. We need to collaborate then. We need to show them. We need to model these behaviors. And if we're not willing to listen to critical thinking about how the project went, or how I could have, as a teacher, done it better, or what would be a great opportunity for the next project, I'm not sure you're going to get the right buy-in. And when you don't have buy-in, you know you're not going to get engagement.

These statements reflected a sentiment from other New Tech teachers who were not taught to model the changes they hoped to see in their classrooms.

During the course of this study, New Tech did not differentiate supports based upon perceived school capacity or quality of implementation. Instead, the organization rolled out its supports at different paces, given what the school development coach saw in her site visits and heard in conversations with staff. Rather than establish different expectations, New Tech implemented its school interventions in parts, determining mid-stream which supports were appropriate at a given time. Emily put it this way:

> The way New Tech sees it, if a school works towards building its fidelity to our school success rubric, no matter where you are, what school you are, what the demographics are of the student body, that you can be a successful school. With that being said, we're kind of three tiered: project-based learning that engages; technology that enables access to lots of information; and a culture that empowers. My job is to go in there and determine what

areas are the biggest areas of need within that realm. So I think that there are just different areas of need and at much different scales of need.

In practice, this meant that Emily made decisions about how and when to employ supports along each dimension, for every tier of the New Tech model. For instance, at School 3, Emily perceived that, halfway through the first year of implementation, the greatest need was in cultivating a culture that empowered teachers and students. She decided to forego planned supports for the instructional dimension and, instead, focus "on relationships with students and trying to shift the culture there" because, in her words, "what is the point of teaching some project about compounds in chemistry if [the teachers] don't give a crap about the kids?"

Throughout this study, I observed numerous instances of Emily deciding how and to what ends she, as the representative of New Tech, would intervene at the school. Emily described this autonomy as being central to why she loves her job – she gets to "create through identifying those needs." Therefore, while Emily solicited advice from her mentors and peers on weekly coaches calls, she was ultimately making decisions about how much influence New Tech might have over school practices. She was a human filter through which only those supports that she thought were appropriate would be able to get through. As a cultural practice, this strategy lies squarely in the New Tech paradigm, wherein the organization resists requirements and orders and, instead, favors autonomy and inquiry. Emily practiced this philosophy in her coaching, thereby instructing teachers and directors through example how to behave in New Tech.

Inevitable drawbacks to this approach are the consequences of allowing novice coaches to make important decisions about how to layer on the elements of the New Tech model for a school in transition. Emily, one of four new coaches in 2010, was responsible for five first-year New Tech schools in her first year of coaching. Although Emily had experience as a New Tech

teacher, her relative inexperience as a coach affected her ability to make quick decisions about how to address problems as they arose during school visits and training sessions.

As a veteran humanities teacher at School 2 explained, he and his colleagues often felt frustrated about the lack of clear answers or direction from their New Tech training or coaching sessions. They were looking for Emily – or any formal New Tech material – to tell them that they were on the right track, "doing New Tech" correctly. He said that he and his colleagues coined the term, "being New Teched" for the nonspecific answers they received from coaches:

> So when you're "New Teched," […] you ask a question and you get a very indirect answer. An answer in which you feel as if they're telling you you just need to look deeper inside because the answer is within you. And so it's very existential in that sense that it's almost like if you just peel back the layers of the onion a little bit, you'll be able to find this answer. And it's a very determination kind of thing. You know, exploration. And so they're constantly modeling for you what the New Tech approach to teaching is, which is not direct, but very sort of exploratory. It's very much, "Let's teach them the process, let's teach them the skills they need to learn this material, but let's not teach it necessarily directly." Like, "This is what happened and this is what you need to do," and stuff like that. There's almost never somebody telling you that. And so we get our first taste of being "New Teched" when we would ask some of these questions and she would say stuff to us like, "Well, what do you think a good approach to that would be?" And we're like, "No you don't get it, we just want to know what the approach is, could you tell us?"

These open-ended methods resulted in variability in implementation across sites (and even within them) but it also helped teachers adopt the "New Tech approach," with practices determined by participants and context.

The philosophical orientation of the model, based in student- or school- driven decision-making, led some outlet staff to be concerned that there weren't enough requirements to help support common implementation. The director of School 2 said:

> I think that there's some pieces of what we do that may make some sense to have a little more structure from New Tech. Almost to say you could make any grouping of classes that you want, but it might make sense to say, you know what, if you're going to start ninth grade, here's the most successful course combinations and here's why. Because we know that these are really challenging, so why don't you do this one, maybe it's BioLit is the best way to do it. But there's got to be best practices there that if you want to say, "You know what? Not that you have to do this, but if you wanted to implement in this way, we've kind of mapped this out."

This sentiment was expressed in other contexts, as well, such as when the director from School 1 struggled with his school-within-a-school dynamics. By resisting structure and formality, New Tech risked variation in implementation even among those dimensions that could be easily predicted and planned for.

The "Matthew Effect." Despite the documentation of some serious inconsistencies in New Tech's implementation of supports for infrastructure development, I also observed several instances of supports and implementation varying based on the capabilities of schools or individuals. In many ways, the value of New Tech's supports was consistent with a classic "Matthew Effect," wherein any initial advantage leads to "cumulative differences that widen existing gaps" (Ceci & Papierno, 2005, p. 149). Both across and within school sites, I documented differences in implementation of supports that seemed to be related to individual teachers' and school leaders' willingness and ability to adopt the supports being provided. Those

who were more willing and more capable – because of previous training, educational experiences, or orientation – benefitted the most from New Tech's supports and were able to most consistently implement them. Those who were unwilling or less capable encountered more problems in implementing supports, and the supports that were offered did not have as much influence on establishing common New Tech practices. The most evident examples of this phenomenon occurred with teachers and school directors who were either so inexperienced that they struggled just to understand basic teaching and leading methods or they were so disengaged that they refused to take advantage of New Tech supports for practice.

Several teachers in each of the three schools I observed were not supportive of New Tech and, therefore, resisted supports to develop common infrastructure. At School 1, a history teacher was brought in late to the program and was never convinced that she could bridge the gap between her old practices and the new ones she was being asked to adopt. She even requested to transfer mid-year. So, despite Emily's best efforts to engage her in project planning, she barely considered the resources provided when thinking about her instruction. Similarly, at School 3, one teacher was so resistant to New Tech that he let his teaching partner do almost all of the planning and instructional work. When his partner was asked about her co-teacher's use of New Tech supports and adoption of New Tech practices, she said:

> He would get up and he would lecture and I would listen and chime in and I would design, actually, what the kids would do. Because if it was up to him, he would have the kids come in, grab a book, read for 40 minutes, write some questions, do a Q and A.

She thought that one strategy that might help him is to force him to teach in his own classroom next year, where he would be held individually accountable for implementing New Tech practices:

> If he is in his own room he will have to use Echo, he will have to do a project. I would hope that whoever, you know, in administration will be able to check and they will be able to see and it is part of the evaluation process. I worked with the Union on a MOU for a new evaluation tool. So he is going to need to step it up.

In these teachers' cases, New Tech supports, however limited, were not taken advantage of and the teachers allowed for little possibility of high fidelity implementation.

At School 2, several teachers expressed frustration with their director, because he was unable to implement many of the supports New Tech offered, both to help him develop a collaborative school culture and to assist his staff in project-based learning. One humanities teacher said that he did not think his director had enough experience with students or education and, because of that, he did not understand a lot of what he needed to in order to be a good school leader. School 2's director was easily distracted by the demands of being a first time principal in a brand new building, and his teachers perceived this as not being committed to full implementation of any one support. A veteran math teacher there said:

> On any given day it's something brand new that's going to be something we have to do because "It's so cool; it's going to be really neat. It's going to make our school all that much better." And remember I said I'm a plodding implementer. Don't do that to me. Let me take something and at least try to get it under my belt, much less master it, before you lay something else on me. He's sort of a person of the moment that way.

This same teacher also mentioned the relationship between his director's lack of experience in education and his difficulties as a building leader:

> He is still continually focused on the building and how you're impressed by the looks and maybe not what's going on inside the building. And once again, in his defense, I will say that I think that's just because he does not come from that educational background.

The director of School 2 struggled throughout his tenure to become a new principal and to adopt New Tech-based strategies for leadership. The demands of doing both simultaneously seemed related to a half-hearted implementation of the supports New Tech offered. After the first two years, he was dismissed from the school and replaced with a more experienced leader.

While the director of School 2 struggled to take advantage of New Tech supports because of his lack of leadership experience, the director of School 3 struggled because of a lack of interest in adopting the program. She was a veteran principal who was planning to retire after one year of New Tech implementation, and, unlike the other school leaders I observed, she was not deeply involved in bringing New Tech to the school in the first place. Therefore, although she participated in the same training sessions as the other New Tech directors, she was far less familiar with the core tenets of the program than they were. For instance, several teachers mentioned that she seemed confused by the team-teaching concept that New Tech promoted to support project-based learning, wherein two subjects are integrated into one course with two teachers. As one veteran science teacher at School 3 described, this made the director challenge the grading practices of the teachers:

> We're sitting at a staff meeting when the first report cards are getting ready to come out, and our principal didn't even understand that BioLit was one grade, that World Studies was one grade, that American Studies was one grade, Chem Tech was one grade. I mean how can you sit through all the meetings we sit through and not know that?

So it wasn't just that New Tech's supports for directors had limitations, it was also that directors' lack of interest could allow them to disengage to the degree that they would not be helpful in supporting the model. In another instance, a humanities teacher at School 3 described how the director refused to conduct a classroom observation for evaluation purposes because the teacher was not exhibiting direct instruction:

> I said, "Well this is how we teach in New Tech. This is me teaching. This is me teaching the New Tech way." And she said, "Well I am going to have to see you, like, direct instruction." And so we had to—I am not the only one that happened to – so everybody then we just had her come in when we did a workshop.

This degree of disengagement with the New Tech program also seemed to cause problems for implementation of supports throughout the school, such that teachers in School 3 were not given the same opportunities other teachers had because their director did not facilitate or allow for them. One teacher suggested that the director was the cause of many of the school's culture problems: "I hope New Tech understands that with the right principal, most of these problems, these kinds of obstacles, will go away."

Similarly, some of the problems of implementation originated at the district level, with teachers and directors not feeling as if they were getting the support they needed from their own districts in order to fully take advantage of what New Tech had to offer. At School 3, the New Tech program itself was tied up in teachers' feelings about the superintendent who brought in the program. Their skepticism of the superintendent interacted with New Tech's supports for building infrastructure, so that implementation was more difficult than it might have been. Emily agreed with teachers' assessment:

> I think that their superintendent is crazy. I think he has a lot of good intentions, but his mind is spinning in a thousand directions and he hates teachers. He thinks that he's telling them everything, but it's happening in that little room and they've seen him talk negatively about them. Anything he does, even if it is well intentioned, is looked at as not.

These dynamics influenced the variation in implementation of school-level strategies, such as culture building, as well as the implementation of the instructional model. Emily had to learn ways around teachers' discomfort with their superintendent, in order to motivate change. These negotiations happened most often among informal conversations between Emily and her coaching peers. But the negative feelings and their implications for implementation persisted throughout the study. At the end of the second year, the superintendent had been dismissed and teachers were hopeful about what a new superintendent's perspective would bring to the implementation of New Tech.

Discussion

When district and school leaders decide to pay for the services of an external school improvement organization, they do so with the expectation that the organization will help their teachers and school leaders implement a particular school model with high fidelity. Rather than hope for a thousand different riffs on instructional practice, the mark of a useful program is that most participants are doing roughly the same kind of practice. But most schools, especially comprehensive high schools, are not designed with infrastructure that would allow common practice to occur naturally. Instead, most school leaders and teachers have decided on their own what their classroom and school practice will look like, and they have not been held accountable for adhering to particular ways of doing things. In addition, most American classrooms do not have the infrastructure – or common materials, technology, curriculum, etc. – to support

common practices across diverse sites. Finally, the teaching profession has been designed as fairly autonomous, with teachers wielding substantial control over their instructional decisions. Because of these ingrained characteristics, it's essential for external school improvement agencies to design and implement supports for building necessary infrastructure where it does not exist. That includes both formal materials and tools but also common understandings about how and why practice should be conducted in particular ways. Indeed, this is one of the principal reasons for partnering with an external organization rather than building school improvement programs in-house.

The case of the New Tech Network and its model for school improvement provides a revealing look into the challenges of developing new infrastructure and implementing it in consistent ways across diverse school settings. In particular, this study of three New Tech schools in Michigan unveiled how even decisions about which schools an organization can or should partner with seemed to significantly influence the likelihood that supports would be implemented consistently. The fact that New Tech did not set specifications for school configuration or structure; school performance or human capital capacity; or even environmental friendliness toward the model made it so that the few formal resources the organization provided were often insufficient in supporting the diverse needs of schools. In addition, New Tech's nonchalant use of its conditions for success to determine whether a school was poised for New Tech implementation made it so that, from the beginning, some schools were able to implement the program more smoothly than others. The schools in this study struggled with the implications of not meeting the initial conditions of success that New Tech established, long after New Tech itself had stopped evaluating schools based on those conditions.

My findings indicate that schools contracting with external service providers would benefit from continued support after the initial adoption of a reform. For instance, at School 3, the likelihood of teachers fully taking advantage of the technology supports New Tech offered – such as Echo, tech support, and technology coaching – was diminished by the fact that the school had never met the initial criterion that all students have access to a computer. Since a web-based organizational system is at the center of New Tech's model for project-based learning, this condition remained essential to the high fidelity implementation of the instructional model and undermined other supports that were coordinated by the school development coach. As other organizations design criteria for adoption, they should consider continually evaluating schools' progress toward fulfilling initial criteria and understand the implications for long-term implementation fidelity if they are not met.

These findings also suggest that the openness of certain supports for infrastructure interacted with school characteristics in ways that changed their nature and usefulness. New Tech's cognitive coaching style served the purpose of instilling in teachers and school leaders what it felt to "be New Teched," thereby assisting in the development of relatively consistent school culture practices. But this style also left some staff confused about how to conduct their instructional practice. This was particularly evident when teachers struggled with project planning and they sought help from Emily. While Emily was responsive and engaged, she was taught to turn teachers' questions back on them and push them to figure it out for themselves. Some teachers rose to the challenge, but others just felt frustrated and disenchanted with the program, as if they weren't really getting what their schools had paid for.

The openness in New Tech's style for implementing supports seemed to compound the Matthew effect that I observed across sites. Those teachers and directors who responded well to

the lack of specificity in New Tech's supports continued to take advantage of them when they could. Those who did not respond well, or who were already disinclined to fully participate in the program, retreated to the tools of their former instruction and stopped trying to engage New Tech's supports.

New Tech seemed to accept a certain amount of variation in how its program was implemented; a major tenet of the model is that learning is more likely to occur if students are leading the work themselves. But this acceptance of variation has important implications for those who want to understand program impact, especially through quantitative impact analyses. If every allowed and accepted variation leads to unexpected or discouraged variations, it is difficult for external observers to untangle what the New Tech program really is and, in turn, what its impact on student learning may be. With so much left up to individual schools and teachers to work out on their own, some may wonder whether there is much value-add in a long-term contract with an organization like New Tech.

These issues are certainly important to consider as New Tech continues to refine its model and scale up its implementation in even more, and more diverse, school settings. They are also important for school-based personnel who are considering partnering with an organization like New Tech. Implementing a program with so much open-endedness requires discipline on the part of a school in recognizing what New Tech can and cannot provide and filling in the infrastructure gaps with resources of their own. Indeed, this kind of negotiation of various resources and programs was exactly what one intermediate district coordinator observed in the high performing New Tech schools in Ohio and Indiana. At a director's meeting late in year 2 of Michigan implementation, she said that directors at these schools recognized New Tech's value

but also its limitations, and they used their power to pull together complementary resources to fill holes.

Conclusion

Externally sponsored school reform is highly complex, with moving parts that are difficult to follow and document. This study sought to explain how one organization developed resources to support educational infrastructure where it did not previously exist – a herculean task even in one school, let alone in many schools across a large geographic area with varying degrees of capacity and buy-in. What I found was that the design of supports is not sufficient for ensuring common implementation – commitment to formal resources, considerations for in-school dynamics, and the various capabilities of actors in school sites all contribute to how infrastructure is established and the likelihood that infrastructure will result in common supports across schools. This study advances our understanding of the potential value of external school reforms and what they can and cannot guarantee. It provides important evidence that both reformers and school-based personnel can use to make decisions about how and to what ends they may engage in the work of school improvement together.

APPENDIX

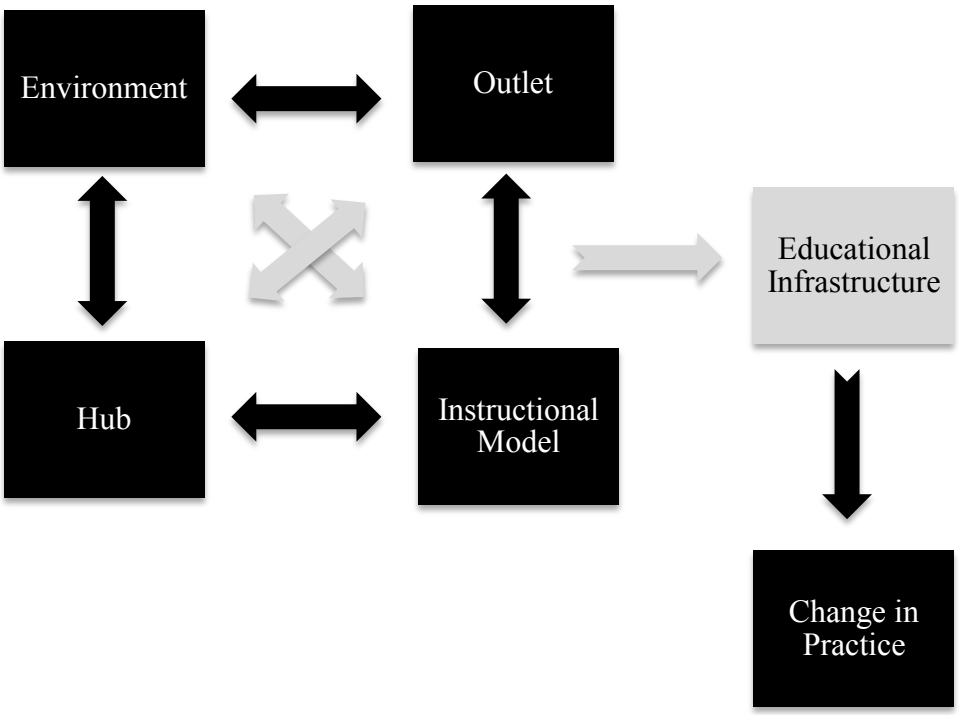

Figure 2. Organizational Dynamics Influencing Educational Infrastructure. This figure illustrates the actors who participate in externally sponsored school reform and the result of their efforts. The grey components are the focus of this paper. The interactions between environments, hubs, outlets, and models influence the development of educational infrastructure to support implementation of the model in diverse outlets.

Table 3
Frequency of Codes Used to Analyze Infrastructure Supports in New Tech

Code	Communicate with New Tech	Culture Problems	Gaps in New Tech Preparation	Instructional Design	Design Changing or In Flux	Design Differentiation	Intervene Community	Intervene District	Intervene Principal	Intervene School	Intervene Teacher	New Tech Characteristic	New Tech Coaching	Coaching Changing or In Flux	Coaching Differentiation	New Tech Function	New Tech Lack of Capacity	New Tech Mission	New Tech Requirement	New Tech Structure	Totals
Communicate with New Tech			3						1			1	10								17
Culture Problems			7			1						1									24
Gaps in New Tech Preparation	3	7		24	1						1	11	21	1			1	2		3	123
Instructional Design			24		3					2	1	11	5	1	1			1			96
Design Changing or In Flux			1	3		1						1	1	1							9
Design Differentiation		1			1					1							1				7
Intervene Community													1								1
Intervene District									3	3			2			2			3		15
Intervene Principal	1							3		4	1	1	5			2					22
Intervene School				2		1		3	4		1	1	2			2			1		18
Intervene Teacher			1	1					1	1		4	3							1	12
New Tech Characteristic	1	1	11	11	1				1	1	4		4			1		3		2	55
New Tech Coaching	10		21	5	1		1	2	5	2	3	4		4	1	3	3		1		82
Coaching Changing or In Flux			1	1	1								4				3				12

Table 3 (cont'd)

Code	Communicate with New Tech	Culture Problems	Gaps in New Tech Preparation	Instructional Design	Design Changing or In Flux	Design Differentiation	Intervene Community	Intervene District	Intervene Principal	Intervene School	Intervene Teacher	New Tech Characteristic	New Tech Coaching	Coaching Changing or In Flux	Coaching Differentiation	New Tech Function	New Tech Lack of Capacity	New Tech Mission	New Tech Requirement	New Tech Structure	Totals
Coaching Differentiation				1									1								2
New Tech Function								2	2	2		1	3								12
New Tech Lack of Capacity			1			1							3	3							17
New Tech Mission			2	1								3									6
New Tech Requirement								3		1			1								12
New Tech Structure			3								1	2									9
Totals	17	24	123	96	9	7	1	15	22	18	12	55	82	12	2	12	17	6	12	9	

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CHAPTER 3

Type and Purpose in Instructional Reform: An Analysis of Practice in the New Tech Network

In public schools across the country, educators are grappling with the competing demands of their profession – accountability, job security, and moral commitments to the children in their care. Teachers, who are increasingly the target of public ire around failing national student performance, have seen education policy shift to a focus on identifying problems in teacher practice, evaluating teachers on the basis of their performance, and, in some circles, developing interventions meant to help teachers improve their practice. While public debate has rested squarely on the first of these two focuses, the question of whether and how teacher practice might be improved has been left primarily up to local school systems to figure out.

In the search for methods for improving teacher practice systematically, so that teachers across a system can take advantage of research-based pedagogical methods, many school districts have contracted with external school improvement agencies to provide replicable models for teacher practice. While organizations vary greatly in the extent to which they intervene in non-instructional components of school organization, the core mechanism for school improvement is typically seen as the instructional model the organization promotes. Complete with an educational philosophy, a design for what practice should look like, and organization-provided coaching, these models are viewed by educators as opportunities to transform their teachers' disconnected and incoherent instructional practices into research-based instructional methods with common elements across the curriculum.

Organizations, especially hub-outlet based agencies that design a central model for proliferation in many diverse schools, partner with schools to provide these models and help

teachers ensure fidelity to the prescribed instructional practices. But the ways in which these organizations organize their models for instructional reform, how they deploy them in schools, and which schools they work in all impact the extent to which the reform is successful. And, although research has examined how the design of instructional models can influence the extent to which teacher practice changes in expected ways, the organizational literature suggests that other interacting variables, including the characteristics of the reform organization, the reform environment, and the school itself, can also influence implementation and likely success. By investigating the implementation of one instructional model – from the New Tech Network – in three schools in Michigan, this study helps to illuminate important considerations for school reformers, educators, and evaluators who are interested in the possibility of externally sponsored instructional improvement. In particular, the aim of this paper is to uncover the degree to which teachers' instructional practice changes when their schools have adopted a novel model for instruction and to account for any variation in change by examining organizational, model, environmental, and school characteristics.

Literature Review

It is difficult to design for systematic change in instructional practice, even among single school settings. But, over the past twenty years, reformers have begun to scale up models for reform that they hope will result in common changes in instruction across many diverse school sites. The unique characteristics of instructional models influence teachers' abilities to adopt new practices in consistent, intentional ways. These characteristics range from the type and structure of models, including how specific they are in designing methods of instruction for diverse and varied circumstances, to the nature of the reform being pursued, including the philosophical or content orientation of the reformers. Evidence suggests that this range of characteristics, and

their interactions with school-based actors, makes predicting the form and degree of change quite difficult, especially early in the reform process. As school and district leaders pursue instructional models that will allow their teachers to change their practice and, in turn, improve student learning, it is essential that they understand how these characteristics may interact and, in turn, influence the likelihood of systematic change in practice among their teachers.

Coherence, Elaboration, and Scaffolding

School reformers organize and design their models for reform in different ways based on their beliefs about how instructional change can and should occur and to what ends. Those that have compelling evidence that specific instructional maneuvers are most likely to result in improved student learning are more likely to set firm limitations on the practices that would count as being "in model." Alternatively, those that have evidence that a range of instructional practices within a certain instructional orientation could improve student learning, depending on circumstances, tend to be less firm about the boundaries of which practices count as being "in model."

Research on school reform implementation and the characteristics related to its success have shown that these different philosophies about school reform result in drastically different types of instructional design for teachers. One important feature of school reform that has been shown to be related to successful and systematic change in practice is program coherence, or the extent to which an adopted reform is highly correlated and aligned with other simultaneous reforms, as well as the degree to which the elements of any particular reform are aligned with each other (Newmann, Smith, Allensworth, & Bryk, 2001). Coherence is important as a design characteristic within a particular program, but it is also important in describing the relationship reforms have with each other and with instructional and curricular practices already occurring

within a school, such that systemic reform becomes more possible the more there is alignment between interventions (Ball & Cohen, 1996; Cohen, 1995; Cohen & Spillane, 1992; Fuhrman, 1993; Smith & O'Day, 1990). Each of these dimensions of coherence affects how likely it is that a reform will result in desired change in practice and improvement in student learning.

There is also evidence that two other features – elaboration and scaffolding – influence the successful common implementation of instructional models, with important implications for how teachers' practice may change (Cohen & Ball, 2007; Reigeluth, 1979; Reigeluth, Merrill, Wilson, & Spiller, 1994). Elaboration, or the "detail with which a reform is developed," and scaffolding, "the degree to which the innovation includes a design for and other means of learning to carry it out" allow us to categorize instructional models across a spectrum (Cohen & Ball, 2007, p. 7). A spectrum of instructional models might include: on one end, classroom interventions for teaching specific subjects (e.g., the Reading and Writing Project developed by Lucy Calkins); in the middle, frameworks for school culture and general instructional strategies (e.g., KIPP); and, on the other end, whole-school reforms with specified curricula, student activities, and tightly controlled measures of success (e.g., Success for All). While many organizations may be capable of producing change in practice in isolated events in individual classrooms, elaboration and scaffolding play a role in how interventions at multiple levels produce desired instructional change in volatile school systems.

Highly elaborated models allow less room for interpretation and confusion about the precise changes that are expected in practice. They provide detailed directions to govern teacher and student behavior in many different classroom situations, with clear guidance as to how and when one might divert from those directions. An important distinction is that elaborated models

are very clear about the circumstances under which specific teaching maneuvers are called for – and why.

Conversely, models that are not highly elaborated typically provide guidelines for practice in general but do not specify particular behaviors for many different instructional moments. There are advantages to this openness; in particular, teachers feel as if they still have some degree of autonomy over their practice, which has been found to be related to teacher satisfaction and retention (Kennedy, 2005; Lortie, 2002). And, in investigations of externally sponsored district-level change, organizations with less elaborated models for reform had fewer human capital and financial burdens (Glazer, 2009). But the risk with underdeveloped elaboration and scaffolding is that teachers will interpret guidelines in disparate ways, making it difficult for organizations to plan for coaching and support that will make sense for teachers across diverse sites (Cohen & Ball, 2007). In addition, weak elaboration makes program "impact" difficult to identify, since various riffs on practice could be related to the program but could also be a consequence of unique interpretations and implementation of the program.

Project-Based Learning

Every instructional reform has a particular pedagogical orientation or philosophy about how best to educate students. This philosophy is connected to desired outcomes, or what the reformers hope students will be able to know and do at the end of a particular instructional unit or educational experience, whether that be a class period, semester, or K-12 career. One instructional orientation that has permeated school reform programs for decades is focused on student-driven, hands-on instruction. These constructivist approaches to teaching and learning are not new. Dewey, over a century ago, wrote:

Abandon the notion of subject−matter as something fixed and ready−made in itself,

> outside the child's experience; cease thinking of the child's experience as also something hard and fast; see it as something fluent, embryonic, vital; and we realize that the child and the curriculum are simply two limits which define a single process. (Dewey, 1899)

One modern interpretation of Dewey's philosophy is project-based learning. Project-based learning instructional methods are typically juxtaposed against traditional teacher-centered instruction, wherein teachers plan the content and lead the delivery of content with each instructional maneuver. Project-based learning advocates work toward putting students' interests and desires first, designing opportunities for them to learn through their own discovery, under their own agency. American schools have seen many attempts to implement these types of instructional practices over the last century. And, yet, the research base on project-based learning or hands-on instruction in K-12 settings has been constrained by norms of classroom practice that resist this transformation.

Project-based learning is typically defined in terms of how students learn material and what structures are put in place to help them learn. One study described the method as "a comprehensive perspective focused on teaching by engaging students in investigation" in which "students pursue solutions to nontrivial problems by asking and refining questions, debating ideas, making predictions, designing plans and/or experiments, collecting and analyzing data, drawing conclusions, communicating their ideas and findings to others, asking new questions, and creating artifacts" (Blumenfeld et al., 1991, p. 371). Similarly, others have defined project-based learning as experiential while at the same time focused on meaningful problems that require solutions (Barrows, 2000; Hmelo-Silver, 2004; Torp & Sage, 2002). Indeed, Sizer (2004) argues that it's essential for learning activities to be focused around a driving question that serves

an important intellectual purpose. It is through this tight focus on a problem or question that students can think critically and learn new content.

But project-based learning instructional methods are novel to most teachers and students in the U.S. and beyond, where instruction is typically teacher-centered and task oriented. Because of this, many previous attempts at scaling these methods in diverse schools have failed. Blumenfeld, et al. (1991) have argued that these endeavors failed to account for the complexity of student motivation and what is required of students when they are asked to lead their own learning. In addition, they argue that too little attention was paid to teacher commitment, knowledge, and classroom organization, resulting in poor implementation of projects. In fact, because project-based learning requires teachers to be highly knowledgeable of subject matter content, gaps in teacher training and development seemed to prevent the broad adoption of these methods.

In addition, many project-based learning models rely too heavily on group work for tasks that are not appropriate. Project-based learning requires the careful coordination of classroom organization, social dynamics, and structured scaffolding activities that allow students to feel supported as they pursue learning. There is limited evidence that teachers and schools are able to adopt these methods without highly structured supports and interventions that help them transform the nature of teaching and learning in American schools.

For instance, neither the What Works Clearinghouse nor the Best Evidence Encyclopedia identifies an effective project-based learning whole school intervention, citing only one whatsoever (The Creative Curriculum), which has not been found to be effective (What Works Clearinghouse, 2012). In addition, Borman et al. (2003), in their meta-analysis of comprehensive school reforms, found that, of the ten models with elements related to project-based learning

(e.g., "authentic" curriculum and instruction; interdisciplinary curriculum; and collaborative learning), seven had the greatest need for more research on their effectiveness. The authors categorized only one, Expeditionary Learning Outward Bound, as having "highly promising evidence of effectiveness." An early review of research (Thomas, 2000) found that the formal research base on project-based learning had only begun to emerge in the 1990s, and that it was very spare. Moreover, the review on project-based learning evaluations reported that students struggled to maintain motivation for pursuing questions, students failed to work well together in groups, and teachers grappled with conflicts between project-based learning instructional techniques and deep-seated beliefs about teaching and learning, including the tension between allowing students to seek their own answers and the demands of state curriculum.

A highly developed line of research by Blumenfeld, Fishman, Krajcik, Marx and others extensively documented the challenges faced by students and teachers in developing and enacting highly-developed projects for use in project-based learning classrooms, including: students' need for scaffolding to help them ask higher order questions that are still authentic; teachers' unwillingness to increase planning time to meet the new demands of designing projects; the trouble teachers had in pacing lessons differently than they had in the past; and, especially, teachers' resistance to using inquiry-based strategies when they conflicted with traditional practices (Blumenfeld, et al., 2000; Krajcik et al., 1998). Ultimately, the authors found that, in order to ensure high level implementation at scale, they had to limit their vision of openness that they originally began with and use highly structured methods to achieve the results in student learning they sought (Krajcik & Blumenfeld, 2006).

All of the above suggests that, in order to see both desired change in practice and positive learning outcomes for students, instructional reforms grounded in project-based learning must

account for their novelty and the lack of embedded infrastructure to support such methods. In addition, the project-based learning literature reveals important implications for model design. In particular, the demands of project-based learning seem to require more attention to what, how, and when teachers' practice must change, making elaboration and scaffolding all the more important.

Technology in Classrooms

While most instructional reforms have a particular instructional orientation, many often also have an orientation toward the best tools for instruction. Project-based learning reforms are often paired with opportunities and demands on educators to incorporate technology – or computer-based tools – into learning. Since personal computers became accessible to the masses, schools have attempted to successfully integrate the latest technological innovations into public schools, offering students new ways to engage with content. From the early days of green and blue Apple monitors crowding whole-school computer labs, to contemporary classrooms where iPads and laptops are the norm, educators have wrestled with how to ensure technology is used as a tool to expand learning rather than distract from it (Lytle, 2012).

Some authors have argued that schooling as we know it is incompatible with the full and robust use of the most recent technology. In particular, the idea that knowledge can be mass-produced (rather than customized to a particular learner), and that a teacher may not be the resident expert in a classroom (given the vast amount of information that can be queued up even on students' smart phones), makes integrating technology difficult for many teachers (Collins & Halverson, 2009).

The consensus of research on the use of technology in schools is that it is a means rather than an end to learning (Ringstaff & Kelley, 2002). Technology in classrooms seems to work

best when it is the best tool for learning or discovery and educators have a clear plan for how that technology will bring about the most engaging learning for students. Despite this consensus, many practitioners adopt technology without fully considering how it will be used and to what end. One consideration that is often not made is whether students will be learning "from" computers" or "with" them. On one hand, learning from computers indicates that students will be engaging a computer as if it was a teacher replacement with which to transmit knowledge (Reeves, 1998; Ringstaff & Kelley, 2002). On the other hand, learning with computers indicates that students are engaged in higher order thinking skills to employ computers as tools in discovery. These different orientations to computer use in schools mean that instructional models must tend to the varying problems imbedded in – and supports required to ensure – successful technology integration. Learning from computers requires less teacher training and support, since the computer applications are driving the curriculum rather than the teacher. But the potential outcomes from this kind of use are limited to higher achievement on standardized tests of basic skills (Ringstaff & Kelley, 2002).

Learning with technology, or using technology to solve problems, has the potential for a bigger return on investment than the previous method, but it requires significantly more training, support, and multi-level reform than learning from computers. In their review of the literature on technology in schools, Ringstaff and Kelly (2002) found that "although technology can support educational change, it will have little impact without accompanying reform at the classroom, school, and district level" (p. 11). Teacher training, in particular, is an essential prerequisite to frequent, appropriate technological use in classrooms.

Whether, and how, instructional reforms rely on technology as a major component of teacher practice has important implications for model design. If students are meant to use

technology in new ways, teachers must have opportunities to learn how to facilitate its use so that students can learn with it instead of just from it. As reformers develop these models, it is important for them to consider how the novelty of their teaching methods – such as project-based learning – and the technology required to implement them, may require different degrees of elaboration or scaffolding in order to support the change in practice they want to see.

Research Questions

This paper will focus on how teachers' practice and their perceptions of their practice are influenced by a school reform program focused on project-based learning and the use of technology to engage learners. In particular, it will explore the following questions:

- To what extent and in which ways do teachers' practice or perceptions of their practice change during the initial implementation of a project-based learning, technology-focused school reform model?
- What features of school reform influence the ways in which instructional practice changes?

Using qualitative research methods to explore the implementation of one project-based learning, technology-driven instructional model in a set of three unique school contexts, this study will contribute to our knowledge of how school reform influences change in practice.

Methods

While many studies of instructional reform have employed quantitative methods to analyze the impact of changes in practice on student learning, this type of research often neglects an intermediate step – whether and in what ways practice actually changed. The assumption is that school reform will have a relatively predictable impact on practice, even across diverse classrooms and schools. Implementation and organization literature, however, have shown that

this assumption does not typically bear out in reality. Instead, school reform implementation is influenced by myriad factors beyond what reformers ask teachers to do differently, including teachers' interpretations of what they are being asked to do; their prior experiences with teaching and learning; school culture and support for reform; and methods of training employed by the reformers themselves. Therefore, it is critically important that research fills the gap between reform and impact, by examining whether, how, and why teachers' practice does or does not change in school reform.

In order to examine these dynamics in a project-based learning, technology focused instructional reform program, this study uses qualitative case-making methods. In the tradition of Yin (2009), I apply an exploratory case study approach to questions of whether, how, and why practice changes as teachers in three schools adopt a project-based learning, technology focused instructional reform promoted by the New Tech Network. Because the story of this reform played out simultaneously with data collection and analysis, this method is sensitive to the changing dynamics of organizations and human participants as they grapple with the novelty and challenges of reform. In the following sections, I describe the case and outlet sites that were the focus of this study, as well as the data that were collected and how they were interpreted to draw findings and conclusions related to change in practice.

Case

The New Tech Network (hereafter New Tech) is a national school improvement organization that began with one high school in 1996 in Napa, California. It has scaled up to almost 100 schools in the last decade and a half, with broad philanthropic investments (most notably a $6 million Gates grant) and acquisition by a large education enterprise called Knowledge Works. New Tech's model for school reform is founded on the principles of project-

based learning and includes a model for collaborative school culture based on "trust, respect, and responsibility" and technology integration, including a requirement of one-to-one computing for every student and a web-based portal called Echo, which is a key component to the instructional reform.

New Tech is an ideal candidate for an investigation into how the organizational and model design for instructional improvement may influence whether and how practice changes within a school reform program. As New Tech has grown, it has significantly broadened the type and conditions of the schools it works with. Rather than limiting its reach into particular school configurations, like schools within a school, or schools with particular capabilities or proclivities, such as those with a STEM focus, New Tech has established sites in all kinds of educational environments. This broad reach played out in the first Michigan cohort of six New Tech schools in 2010: two were whole-school conversions, two were newly established schools, and two were schools-within-schools. By implementing its model in dissimilar outlets without formal attempts to vary its supports, New Tech is a prime candidate for understanding how variations among environments and outlets, in particular, influence the implementation of a school reform model.

The data collection and analysis for this paper were conducted as part of a broader two-year study into New Tech implementation in three Michigan schools. School sites were purposefully selected to represent three variations in type, in order to gather data on how New Tech is implemented in different contexts. School 1, a school-within-a-school, was an early New Tech-adopter. It is located outside of a large metropolitan area in southeast Michigan – its principal calls it "suburbal," part suburban and part rural – and its students are predominantly white, with only 16% who qualify for free or reduced lunch.[2] School 2, a new school site in a

[2] All school demographic data were provided by school principals in 2010.

small city in western Michigan, is the most diverse of the three sites, at 48% white with a mix of African American and Latino students. 60% of students at School 2 qualify for free or reduced price lunch. School 3, which adopted New Tech as part of its school turnaround proposal to win a federal school improvement grant in 2010, is 84% African American and 78% low-income.

Data

Over the two-year study period, qualitative data were collected from multiple sources in order to establish the most accurate portrait of whether, how, and why practice seemed to change in response to the reform. The study began with observations of the summer 2010 New Schools training, during which I took extensive notes during more than 15 hours of workshops, lectures, and school team meetings in Indianapolis, Indiana. Then, over the 2010-2011 and 2011-2012 school years, I observed five to ten staggered days of instruction, coach-facilitated meetings, and student behavior in each of the three school sites. Each of these observations included a faculty meeting, classroom practice, and coach-led one-on-one meetings with teachers. In addition, I observed classroom practice of three teachers in each building before and after interviewing them. All observations were participant observations, in which I responded when addressed and offered some limited thoughts on my observations.

I also interviewed school leaders in all three buildings and the superintendents of two buildings. The superintendent of School 3 was dismissed during the course of this study and did not participate in interviews. Each interview was recorded and transcribed, and informal conversations with interviewees were used to check understandings and accuracy of the interviews. In addition to school-based observations and interviews, I conducted three interviews with the New Tech school development coach, who was responsible for all three schools in the study, and I interviewed two intermediate school district officials who were instrumental in

bringing New Tech to Michigan. Finally, I participated in and wrote observational notes on six director's meetings, which were facilitated by the intermediate school district officials and were attended by the principals of the Michigan New Tech schools.

In addition to observational and interview data, I collected formal written documents from New Tech trainings and the New Tech web portal, Echo. At the New Schools summer trainings in 2010 and 2011, I took notes on the formal content presented as well as the informal conversations between outlet and hub staff. New Tech agreed to participate in this study and signed consent forms to give us access to materials and trainings. School district superintendents and building principals signed consent forms to allow access to all classrooms and faculty gatherings. All quoted participants agreed to be interviewed and have their classroom practice and school participation observed.

For each teacher interviewed for this study, I formally observed teaching practice at least three times – once in the first half of the 2010-2011 school year and twice in the second semester. I documented classroom artifacts, lessons, evidence of student learning, and project objectives. I used these observations as discussion points in semi-structured interviews about teachers' practice and adoption of New Tech-supported approaches to teaching and learning. All first interviews were conducted face-to-face, either in person or via Skype video chat. I conducted semi-structured formal interviews with three teachers in each school, New Tech superintendents, directors, and two intermediate district coordinators. Follow-up interviews with the school development coach and one of the intermediate district coordinators were conducted in person. Follow-up interviews and correspondence with other subjects were conducted via email or Skype.

Analysis

Building on the literature on how school reform models are adopted in interaction with their hub organizations, the larger environment, and their outlet schools, I analyzed both the type of model New Tech provided – with special attention to the extent of coherence, elaboration, and scaffolding – and the purpose of the instructional change New Tech seemed to support. Considering for both type and purpose, I was able to understand how these dimensions may work in tandem to create the circumstances under which practice transformation is or is not possible. See Figure 3 below for an illustration of the organizational dynamics related to reform-based instructional change that I used to guide my analysis.

I used Dedoose qualitative research software to analyze interview transcripts and observation notes. I designed a set of codes based on the literature and analytic lens described above, and I coded excerpts of each written document. In addition, I reread documents to determine themes that were missing in the codes already created. I then established new codes and reread documents, coding for themes that reemerged. The software allowed us to aggregate the codes and determine patterns that emerged in the story of New Tech implementation. These patterns informed my understanding of how teachers' practice had changed since New Tech adoption, as well as the ways it had changed and why. Examples of codes used to create excerpts for this analysis include, "teacher change;" "teacher not change;" "pedagogy pre-New Tech;" "pedagogy post-New Tech;" and "gaps in New Tech preparation." See Table 4 for a list of the codes used for this analysis, as well as the patterns among codes.

Findings

Drawing primarily on teachers' perceptions of their own practice, as well as observations of the practice of all of the teachers in this study, I was able to document evidence of whether and how teachers changed their practice in three Michigan New Tech Network schools. I also

documented hub, model, environmental, and outlet characteristics to determine which features seemed to influence whether and how teacher practice changed. I present the findings in four sections. First, I describe how New Tech intended for its teachers' practice to change and the basic characteristics of the hub organization and model. Then, I explore whether most teachers' practice and attitudes toward teaching and learning changed while in the New Tech program. In the last two sections, I analyze the ways in which the hub, model, environment, and outlets influenced whether and how teachers' practice changed.

New Tech's Instructional Model

Project-based learning. The New Tech Network describes its instructional model as a project-based learning approach. As New Tech defines it, project-based learning is a pedagogical orientation that positions the teacher as facilitator rather than leader. It is based on the Buck Institute's model for project-based learning, described on its website as follows:

> In Project Based Learning (PBL), students go through an extended process of inquiry in response to a complex question, problem, or challenge. While allowing for some degree of student "voice and choice," rigorous projects are carefully planned, managed, and assessed to help students learn key academic content, practice 21st Century Skills (such as collaboration, communication & critical thinking), and create high-quality, authentic products & presentations. (Buck Institute for Education, 2012)

New Tech provided written materials that documented "essential" components that New Tech teachers could carry out in order to implement project-based learning. These included: capture students' interest through an entry document that helps them think about what they need to know; develop learning outcomes that will guide how a teacher measures success on the project; engage students in inquiry; require students to innovate; give students a meaningful "driving

question" to guide their work; encourage students to make their own decisions about how to proceed with the project; require students to give a public presentation to explain their findings; confront "significant content and authentic issues;" and "incorporate critique and revision."

New Tech specified that courses be co-curricular, meaning that teachers from two content areas would teach one class that combined their areas of expertise into joint instructional projects. New Tech did not specify what these pairs should be, but classrooms in the network had various arrangements, such as Biology and Literature; American Studies and English; and Physics and Geometry. The project-based learning tenets were described as a series of processes that New Tech teachers and principals could enact. New Tech also described processes related to Echo, the organization's online learning portal. Teachers' practice, for instance, was not described as "proficient" unless they used Echo's online course calendar to drive all classroom activities.

Problem-based learning. After several years of dissatisfying results on math student assessments, as well as complaints from math teachers that they were not able to teach the content they needed to, New Tech switched from a *project*-based learning instructional approach to a *problem*-based learning approach for math. While many of the philosophical tenets behind project-based learning were still embedded in problem-based learning, teachers were allowed to design much shorter instructional units (a few days rather than a few weeks), spend a bit more time doing whole-class direct instruction, and focus slightly more on math content development than they had previously. A math teacher at School 1 described problem-based learning as being a condensed version of project-based learning: "You still go through 'needs to know,' you still have workshops, still scaffold, but it's condensed to two days, or three days, or one day."

Technology. New Tech schools were required to provide computers to each of their students while in class, and teachers were asked to put all of their project-related documents or

instructions on Echo, New Tech's online learning portal. This would allow the computer to serve as students' home base for learning and information, and the teacher could move to the background. Teachers were also asked to use technology to search for project ideas, either on the internet, or through New Tech's project library, a collection of previously-designed projects.

Cognitive coaching. New Tech's approach to staff development was called "cognitive coaching," which was described as an inquiry-based method in which coaches would probe teachers with questions rather than tell them explicitly what or how to behave or think. The idea behind this approach was that teachers needed to change their teaching behaviors to be more inquiry-based and focused on students and that, by coaching them through an inquiry method, they would learn what this experience felt like and be able to translate that experience into their own teaching methods. New Tech avoided extensive formalized materials to support teacher learning. Instead, it relied heavily on coaches' abilities to facilitate productive conversations and thinking between New Tech teachers, so that they would decide on their own how best to approach their instruction. When formal documents were used, they were typically in the form of rubrics that described categories of practice, which teachers could use to gauge whether they were on the right track. These rubrics also served as an instructive tool for teachers, since teachers were supposed to design project rubrics to assess their students' learning.

Change in Practice and Attitudes

Across the schools in this study, New Tech teachers wrestled with adopting – and then successfully implementing – the pedagogical practices that New Tech promoted. In particular, they pursued project-based learning methods, such as designing projects, writing rubrics, deferring to student interest and questions, and using scaffolding activities to support student learning. They also pursued increased use of technology to enhance their teaching by attempting

to use Echo, asking students to use laptops to learn new information and create project products, and developing their own knowledge of software relevant to their practice.

But, in the first two years of Michigan implementation, no teachers were able to fully convert their practice to New Tech-supported methods. Instead, as one teacher put it, there was almost universal "plodding implementation." Most teachers attempted to change, and many saw small successes along the way. Some teachers, faced with an unwelcome program and a completely new pedagogical orientation, refused to try. On the whole, though, most teachers demonstrated some degree of adoption of New Tech practice.

Several teachers mentioned that, although their practice may not have changed substantially or consistently, they were more excited about teaching than they had been in the past. A humanities teacher at School 1 seemed to think that New Tech gave him permission to practice the philosophy that he had already adopted about teaching but had not had the opportunity to fully embrace:

> The philosophy, the program was in line with the philosophy I already had. Not saying that I haven't refined or changed any ideas and my response to it, but it was pretty congruent. There were other things that were appealing also; the aspect of technology integration was important to me, obviously, from my experience. So the chance to work with that a little bit more deeply. And honestly, I had been; I was starting to get bored with what I was doing. I was itching for a challenge and a way to take some of the ideas that I had about technology and have kind of a test environment to see if I could make them work.

New Tech afforded this teacher the opportunity to explore a variety of instructional techniques that he had always wanted to experiment with but was never given the freedom to.

A math teacher at School 3 said that, despite his difficulties truly adopting project-based learning methods, the program did alter his perception of what his students could accomplish, and it made him feel better about his own practice. When asked if he thought that New Tech had improved his teaching he said:

> I think it's opened my eyes to possibilities. I see a little bit of hope for looking to see what students could achieve. I really see a possibility for a good turn around coming around this next year. And I had the opportunity to leave the district but I actually want to give it another shot. I want to give it another try and try to be the teacher that I want to be, not a teacher that somebody else wants me to be or not the teacher that has to always put the kids in their place, being a disciplinarian and stuff like that which is what I was this year. I was basically the asshole teacher. I was mean.

Similarly, a veteran science teacher in the BioLit class at School 3 said that New Tech had renewed his love of teaching:

> It's sort of, I don't want to say "refreshing;" it's made me feel like - of course it didn't make me feel like I was starting teaching again, I don't want to get sappy. But it was totally different than anything I've ever done and I've enjoyed doing it.

He said that, if New Tech left tomorrow, he would continue trying to practice project-based learning. Another teacher at School 3 said that New Tech had made her more serious about committing to practices she only partially exhibited before adopting the program. "That was a difference, just thinking about what sort of problem that would engage [students] instead of thinking, "Oh, I like this," or just doing something because it was fun," she said.

> The fun can be an engaging part as long as it supports the standard. Now I am thinking, "How does it support the standard? How can it be rigorous? What kind of technology can I put in there?" I guess I am taking it a little more seriously.

So, although many teachers were unable to consistently implement project-based learning methods, some of them felt as if New Tech had taught them something about teaching and learning that they could build on, even if they stopped teaching in the New Tech program.

Throughout my conversations and observations with New Tech teachers, several themes emerged that are useful in helping to categorize the ways in which teachers' practice was influenced while in the New Tech program. In the following sections, I explore those themes through the words of teachers themselves.

Influences of Type and Purpose

On New Tech's website, newtechnetwork.org, the organization advertises its model with a picture and quote from a New Tech teacher. In the quote, she says, "New Tech doesn't hand you strategies and tools and tell you how to use them. Instead, you're challenged to reflect on your practices and push yourself to integrate new ideas that enhance your classroom" (New Tech Network, 2012). New Tech has clearly positioned itself – both explicitly and in the design of its instructional model – as being philosophically opposed to elaboration. This philosophy is connected to the content of its instructional model; because New Tech wants teachers to use student-driven techniques, it resists providing teachers with explicit instructional maneuvers. In a way, the organization employed a "Here you go. Take it," approach to improving instructional practice. The idea was that teachers would learn how to let students guide their own learning by being forced to guide their own development in the New Tech program.

The novel work of project-based learning, combined with the integrated use of technology, meant that teachers were asked to perform practices that they had never even marginally experienced previously. Since all of the teachers in our study had some prior teaching experience, and most of them had taught for many years with traditional pedagogy, they struggled to transform practice in such substantial ways, with little elaborated support. Even practices such as collaborating with a team teacher to design instruction were foreign to most teachers. A humanities teacher at School 3 said, "I have never collaborated with my peers on instruction until this year." Her co-teacher had also "never had daily collaboration" with other teachers to plan instruction, so they both had to learn how to work together, even while they were learning a brand new style of teaching. Another teacher in School 3 seemed to barely consider how working with a co-teacher should be a central part of her instructional practice as a New Tech teacher: "We have a common prep time so sometimes we talk about instruction. Maybe not as much as we should—and hopefully that will change next year."

In this way, the merger of New Tech's *type* of instructional model – unelaborated – and its *purpose* – using technology integrated project-based learning methods to teach high school students 21st Century skills – worked against the likelihood that teachers' practice might change in predictable ways. Because of the complete lack of knowledge about how to conduct project-based learning in schools, teachers were desperate for direction from New Tech. In addition, requirements to have students engage with technology on a daily basis placed severe demands on teachers who were unfamiliar with these methods of teaching and learning. There was also a tension between New Tech's purpose and teachers' beliefs about the purposes of schooling and the requirements of their jobs.

Flexibility in New Tech practice. A central theme that emerged from our conversations with teachers, across all three schools, was that the New Tech program allowed – and, in some cases, called for – diverse views of what was appropriate project-based learning practice or use of technology. Many teachers felt as if New Tech permitted them to use whatever pedagogical practices they liked, and that this freedom in and of itself was part of project-based learning. Some also indicated that New Tech's lack of specificity about what qualified as New Tech practice made it so that they could never be sure if they were teaching the way they should be teaching within the program.

A veteran math teacher at School 2, when asked how New Tech had changed his practice, given his professed "plodding implementation," said that the program had made his practice "much more Socratic." He described his previous practice as being "extremely traditional," which he defined as "text book oriented:"

> You present the lesson, you practice this with the students, show them examples, give them some guided practice, and then individual practice time in class, then lay out an assignment for homework. And then they come back to school the next day, you go over the assignment, and then you go onto the next piece. And then interspersed in there at the appropriate times are quizzes or some other form of summative assessment.

Given this traditional prior practice, this teacher saw small steps toward project-based learning as being significant. For example, he said he did a lot less direct instruction and would use that method only when he was introducing a completely new concept to his students: "I'll give them an example or put a problem on the board that has something to do with real life, a word problem you might call it, and then just ask for needs to know, and eventually work through it with them." By using the "knows / needs to know" instructional tool, this teacher began to integrate some of

what he had learned at New Tech trainings. He was also an eager adopter of problem-based learning, which was New Tech's solution to poor results in project-based learning math classes. He said:

> I realize that if I took PBL, project based learning, and followed it with fidelity, I would not get enough done. The projects would take too long and the content piece would not be addressed sufficiently. So, in consultation with our district curriculum guru, […] we decided and we both sort of suggested it simultaneously to each other, "Why not go to a problem based approach." And that way you can structure a problem anywhere from a day to a week.

The perceived flexibility in New Tech's approach allowed this teacher to practice new methods in a safe environment – one in which he could revert back to past practice when uncertain what to do.

This flexibility led, in some cases, to uneven adoption of New Tech practices. In individual classrooms on certain days, some teachers seemed to exhibit project-based learning instructional practices. A humanities teacher at School 1 said that New Tech allowed him to deepen his practice around helping his students make real-world connections:

> The idea of the real world connections, which I think much more intentionally about than I did before. Before, I was looking for real world connections in the sense of what would be interesting to the kids in their lives, but showing how the task and the learning connects to the larger picture is more important, I think, in this model. The processes, the protocols, that are in place that we use for the students to become more independent, I think is something that's different about the model than what I had been doing.

This teacher emphasized the idea that New Tech's openness allowed for experimentation of all kinds of pedagogical techniques, even if they were outside of the formal model.

A humanities teacher at School 3, who taught an integrated Biology and Literature class and was also the New Tech advocate for the school, said that New Tech had changed the sorts of questions she asked of her students, encouraging them to reflect more on their learning. When asked what was different about her practice in the New Tech program, she said:

> [Students] do a lot more reflecting in New Tech than they did ever before in my traditional English classroom. Like if you have in your critical thinking questions; "What do you think?" They are doing that all the time, as they are building up to their final project. So that is different.

She went on to say that some of her classroom behaviors had changed since being in the New Tech program.

> Physically I move around more, but nothing comes out of my mouth, per se. I'm moving around looking at what kids are doing. I'm monitoring their progress. But I am not sitting up here, for example Romeo and Juliet, we did not [act out] Act III or Act V, the students did a web assignment on it and I sat back and let them explain to me the literary concepts that were happening. As opposed to me lecturing on: "This is an illusion, this is an analogy, this is a sonnet." And instead of me saying, "Okay, we're going to write a hyperbole poem today," they turned around and just did it. So that is different. I'm not writing on the board. It is one thing I do like about Echo, we put our agendas on. I type my little brief thing and it is kind of like, "Here you go. Take it."

This teacher enacted what she considered New Tech instructional methods by allowing her students to take control with little guidance from her. This practice resulted in certain

deficiencies in her students' ability to learn course content, but the attempts to let go of control were valued by the New Tech coach.

A veteran humanities teacher with a specialty in history at School 2 expressed explicit frustration with New Tech's lack of specificity in his initial instructional training. He said that he wished New Tech was more clear about why he should "trust the process," the impact New Tech has on students, and how he should be implementing New Tech. In particular, he said that he did not like when New Tech "suggest[ed] things that he should be doing but then [didn't] tell him exactly how to do it." He described the project creation process as involving looking at the content standards, deciding on an end product, and teaching students mini-lessons along the way, so his understanding of the extent to which his practice should change was constrained by his rather limited view of how his practice could be different.

The director of School 2 expressed his concern that New Tech had not provided what was needed to truly support change in instructional practice. He said, "I'm not sure I've seen the silver bullet in New Tech, right? That's like, 'Oh, well if you just do these 15 things, of course it's going to work well.'"

One teacher described what it meant to not have a clear understanding of New Tech's expectations for his practice:

> They don't have anything that is written in stone that says, "You are a New Tech teacher, you must do this." So, in a sense, that frees you to do what you think is best and then hope that that is more or less aligned with what New Tech says is a best practice, or what they're really looking for from you.

Likewise, a veteran humanities teacher at School 2 explained that New Tech's lack of elaboration and scaffolding allowed him to believe that his practice had changed in positive ways, even if he was not sure if he was doing what New Tech wanted him to do:

> So I think that I have a sense that I'm doing most of the things, but because they're somewhat ill-defined, exactly what New Tech wants me to do, I can sort of live in a fool's paradise where I'm like, "Yeah, I'm doing what New Tech wants."

This gap in understanding about New Tech's expectations allowed other teachers to convince themselves that their prior practice was actually quite similar to the New Tech approach.

One science teacher at School 1 described being overwhelmed by the number of choices allowed within the New Tech model. She said,

> I have got to start with this form. Well then what is this one? It looks like this one. Oh it is just the choice. If you don't like this one you get to use this one. I was overwhelmed with forms. […] You give me too many choices, I am incapable of making a choice.

With more scaffolding provided from New Tech, this teacher may have been able to distinguish between the forms in order to decide which one made the most sense to use at any particular point. In the absence of that scaffolding, though, she was left to muddle through on her own, not considering that there may be important differences that would improve her planning experience and, in turn, her instruction.

When New Tech techniques were employed haphazardly, it left some teachers feeling disappointed with the results, retreating back to past practice for comfort that at least students were learning *something*. Just one year into New Tech implementation, a veteran science teacher at School 3 thought that he and his co-teacher would have to roll back some of the New Tech practices they had adopted:

> We've tried to do more of the facilitator and less of the lecturer. And I think probably next year we're going to have to go slide back a little bit and do a little bit more – they don't want to call it lectures – a few more workshops. We're going to have to put in I think some more structure.

Both he and his co-teacher felt as if the lack of structure they were taught to provide their students was not sufficient at engaging them and ensuring that they learned the required content. With Emily's permission, they were interested in integrating some traditional teaching practices into their instructional repertoire, so that they could draw on them when necessary.

The most important transformation that New Tech requires of its teachers is to spend a great deal of time designing projects before implementation. But many teachers felt as if they did not have the requisite knowledge to take advantage of the scaffolding instruments that New Tech does provide, such as the project library. The project library was meant to be a resource for teachers to acquire the previously designed projects of other New Tech teachers and use them for their own classrooms. When asked whether Michigan teachers had taken advantage of the project library, Emily said that most teachers use the resource to get ideas rather than adopt projects wholesale:

> There's been a few. I definitely know that [School 1] and [School 3] have tapped into those things, but they have been more apt to really take it and create their own versus like use that brief case, I think. But [School 2] Science hasn't. And then otherwise, people have just kind of perused it for ideas and maybe used it as a jumping off point. I think that's been more common than actually using a project.

Because these teachers did not know how to take projects and use them in their own classrooms, or adapt them to suit their needs, they chose to do the much more difficult work of designing

projects from scratch, even while they were starting new schools and learning other novel instructional techniques. When describing how New Tech had prepared him to design projects, a humanities teacher at School 1 said:

> We left New School's training with a lot of theoretical knowledge, but until you implement it, you don't really truly understand it. It's kind of the difference between taking education classes and doing student teaching.

Like student teachers in classrooms for the first time, New Tech Michigan teachers were, for the most part, eager but unprepared for the real work of New Tech teaching.

Regarding the use of technology, one math teacher at School 3 explained that he was unable to do anything innovative with technology because New Tech's designs for its use were underdeveloped. He seemed to believe that New Tech had not designed for the use of technology as an engaging instrument of learning. Rather, it was used as a one-dimensional space to house information regarding projects. He said:

> You know we're talking about this technology, that kids are now into all this technology. Well let's do something different with technology that's going to catch these kids because the stuff we're doing right now, the stuff I did this year, it didn't catch them. I want to cry over it. It's just bad.

So even those teachers who were most eager to use technology in their classrooms felt as if the model was not elaborated enough to show them how to do it well.

The methods of New Tech's instructional model, based in technology integration and project-based learning, demanded further elaboration than the organization provided. By neglecting the *how* in favor of the *what,* New Tech forced teachers to figure out for themselves what was meant by New Tech instruction – sometimes they came close to hitting the mark, but

often they struggled to make basic changes. Unfortunately, many teachers were often unaware that they were so far off, since New Tech had never specified precisely what their practice should look like.

Tensions between New Tech and environmental goals. Several teachers in Schools 1 and 2 expressed a tension between the goals of teaching and learning in their educational environments and those that New Tech seemed to be pursuing. In particular, teachers felt as if they would have to sacrifice essential goals from their environments (and past practices) in order to fully adopt New Tech practices. These teachers were unconvinced that the methods supported by New Tech were sufficient in addressing the myriad goals in their internal and external environments, particularly those related to improving students' factual knowledge and ability to succeed in a high-stakes testing culture.

A science teacher at School 1, while recognizing that there were many valuable lessons that the New Tech approach offered her students, struggled against the idea that the 21st Century skills that they were supposed to be teaching were sufficient in preparing her students for life after high school. She said, "I guess my philosophy is: these kids are people and adults leaving here, rather than freshman or sophomore teenagers, and they need to get through the state curriculum." She viewed the state curriculum as having content that was necessary to ensure her students were "informed voters," indicating that having critical thinking and communication skills was not enough. Because of this disconnect, she felt hamstringed between her desire to fully transform her practice to the New Tech model and her desire to complete the full curriculum while her students were enrolled.

Another School 1 teacher expressed similar reservations about New Tech's emphasis of process and skills over content. When Emily, the school development coach, asked this history

teacher how she was intentionally teaching the schoolwide learning outcomes, she expressed frustration with the tension between those outcomes and the history content she wanted to teach. The teacher told her that she was struggling with it because of the amount of content she was required to cover in such a short period of time. Emily told her that the schoolwide learning outcomes might be just as – if not more – important than the content standards. In response, the teacher replied that she *had* to teach the history standards because they were required. Since her students would be tested on those standards during their eleventh grade state history exam, the teacher said that she would be held responsible for her students' performance.

The impression of a trade-off between teaching content and teaching skills or process was important in teachers' intentionality about changing their practice. While some teachers seemed to attempt to change, with various degrees of success, other teachers intentionally resisted the New Tech instructional methods, because of concern about what their students might be missing in their traditional practice. This theme was most explicitly articulated among the teachers and director of School 2.

A veteran humanities teacher with a specialty in history at School 2 was particularly frustrated by the tension between content and 21st Century skills. He said he was not able to teach all the content he believed students needed, and New Tech did not hold content up as a priority. He said that this made it so that students' grades were incomparable: under the schoolwide learning outcomes, a student could know no content and still get a B.

The director at School 2 further articulated his teachers' problems with implementing New Tech as related to the tension between the teaching of content and the teaching of 21st Century skills. Of all the teachers in our study, the teachers from School 2 struggled the most with accepting that they could not, and did not need to, cover all of the content that they used to

in their traditional high school classes. As he described it, New Tech allowed for more time to teach skills than content than traditional schools did. But he found that it was difficult for his staff to buy-in to the legitimacy of that allocation "because they don't see the long-term picture of what that 21st century skill can do until they're fully developed in the process." He elaborated by indicating that he was not certain that all of his teachers saw the value in engaging "a student so they can become a learner." Instead, teachers were concerned about high stakes state assessments that would tie their students' scores to their teaching performance, as required by recently adopted Michigan teacher evaluation law. The director of School 2 described it this way:

> Our teachers are heavy into content. Content, content, content. Very important because [the students are] going to take a test in a year or two and as a result of that, the powers that be will know that "I didn't teach this student these three components of content. And as a result they'll fail and they'll know it's me."

This sentiment mirrored what I heard from the history teacher at School 1 – because teachers are now held professionally responsible for the content knowledge of their students, they have less freedom to experiment with instructional practices that would push content to the background.

Influences of Unique Actors and Outlets

When asked what the biggest challenges to teachers in adopting New Tech practices had been in the first year of implementation, Emily said:

> The first thing that came to my mind is teachers' assumption that students can't do certain things and therefore not trying things maybe. I can try to elaborate on that. Then the second thing is particularly traditional and more veteran teachers' resistance to a thematic approach that might not allow them to cover every single piece of everything.

> And so that fear of moving away from just content coverage to the value of 21st Century skill development and collaboration, and really setting the tone for that culture in the classroom. Those are two of the biggest ones.

Both of these challenges to changing practice have to do with individual teachers' struggles with the model. Indeed, although New Tech's lack of elaboration appeared to result in great differences in whether and how practice changed, there were also individual differences, among both individuals and buildings, which influenced teacher adoption of New Tech practices.

Prior experiences. Prior to New Tech, many teachers had experienced a flavor-of-the-month phenomenon in which they would be expected to adapt their practice based on every one-off professional development session that the administration coordinated. A science teacher at School 3 said, "I can't remember the buzz names for them anymore because we've had so many of them, but it seemed like about every two or three years. We never really let a program take hold and see it through. It was always whatever was new." A different teacher at School 3 agreed: "Our curriculum here has always been kind of a mess. It is a hodge-podge of things like a quilt and that is not really effective." This policy churn led to skepticism among some teachers about whether New Tech was there to stay or just another program that would be gone the next year. Some of them approached the program as if they needed to just get through it.

A humanities teacher at School 3 said, in May of the first school year of implementation, "It has taken all year to kind of get away from traditional—it is hard because I have done it for 20-some years." While some teachers considered the New Tech approach to be a substantial departure from their previous practice, other teachers felt like they were only adapting practices they had already begun to implement in their previous teaching experiences. A teacher leader at School 3 said, "At the New Tech conference, I remember thinking, 'This is going to be an easy

switch for me,' because, especially in Spanish class, I always was trying to look for ways to get kids up and speaking and working together." Some teachers who perceived only slight differences between their previous practice and the New Tech approach appeared to overestimate the similarities between the two. Indeed, several teachers described shallow interpretations of project-based learning in order to justify its similarity to methods they had used in the past. A veteran science teacher from School 3 said that New Tech had not changed his perception of himself as a teacher because New Tech represented something he always wanted in his teaching. He said:

> This is where I've always wanted to get to. I've always like this idea of, you know, being a facilitator; being a guide rather than just being a lecturer because I find lecturing boring. I don't like doing it all day.

But just because he found lecturing boring did not mean that he was prepared to abandon it in favor of constructivist approaches to teaching. His familiarity with the philosophy of New Tech seemed to make him more vulnerable to misapplication of New Tech practices, since he took less care in performing them than some of his less knowledgeable colleagues.

Other teachers were more accurate in their assumptions that their previous pedagogical practices were similar to what New Tech was asking them to do. A veteran humanities teacher at School 1 said, "Pedagogically, I would say I'm primarily constructivist in my orientation, even before I knew what constructivism was." He went on to describe how this translated into his instruction:

> As a teacher, my focus, I think, has always been on the underlying principles rather than the surface level facts, basic knowledge. Those things are important too, but what is the underlying understanding that's necessary to master this. I tend to prefer mastery and

> depth over breadth on coverage. I think that when students have to grapple with something themselves at a higher level than regurgitation, they're more likely to retain. Doing something with knowledge; translating it from one media to another requires understanding in a way that other more "traditional" teacher activities don't.

Unlike the previous teacher, this teacher's prior experiences with New Tech-like strategies led him to be more thoughtful about the way he chose and implemented practices.

A major theme that emerged in my observations and conversations with teachers was that teachers' prior experiences, or lack absence of experiences, heavily informed their willingness and ability to adopt new approaches to teaching. This phenomenon played out for both seasoned teachers and for novice teachers, although in different ways. School 1 exhibited the greatest range in the transformation of instructional practice among the schools in our study, with both the strongest adopters of New Tech pedagogy and some of the weakest. But, throughout the schools, variations in teachers' professional experiences influenced whether and how New Tech practice took hold.

Among the schools in this study, School 1 had the youngest staff, by age and by experience, with one second-year teacher, one third-year teacher, and several teachers who had been teaching for five to seven years. This relative youth seemed to encourage inventiveness and excitement around new instructional practices, as most teachers were not "stuck in their ways." But it also meant that the least experienced teachers struggled with learning the New Tech approach, while simultaneously grappling with the demands of their new chosen profession. In particular, the time demands of planning outside of class, the non-teaching expectations of the school (such as extra-curricular activities and discipline monitoring), and the work of building

strong relationships with students and parents all influenced the degree to which project-based learning practices were adopted.

A novice math teacher at School 1, for instance, came to New Tech after only one year of teaching in a traditional high school. In that year, he had been given curriculum materials by a colleague, and he was never required to develop his own materials or translate content standards into lessons, let alone build entire project-based units. He said, when asked why he came to the New Tech high school, "I figured I had nothing to lose. I haven't really invested anything in my curriculum yet at the high school because I've been doing everything from somebody else anyway." When asked about his prior practice, he described the classroom of a typical math teacher in most American high schools and the help he received from a veteran teacher who had already designed lessons for his subject:

> It would look like, "Here's what kind of notes you need to give. Here's the worksheet that you're going to give for homework." And then I could always modify things. I put a lot of things digitally in slide shows because I was going from overhead projector film stuff so I would take that and then make it in to a PowerPoint. So that was the majority of my work last year was doing that; not having to come up with what to teach next, which was really helpful.

During the summer training before the first year of implementation, this teacher was seen by his peers and director as a leader in the New Tech program – an early adopter of the philosophy and someone who others could look to for support. This teacher attempted projects and was moderately successful at delivering some project-based learning lessons in his first year teaching in the New Tech program. At the time, this is how he described his practice:

> It's more facilitator than a lecturer, I would say. Because we show them how to do something, but then with a problem like they get in to it, I'm kind of just going around with after they saw the workshop, which was our lecture, just kind of going around seeing how groups are doing. They ask questions, but it's more, I don't know, it's not like I'm the only source of information because they'll find other things – how to do things online with peers. It's more me managing how they can use that information than just providing it. So that's kind of different for the better.

By the midpoint of his second year in New Tech, however, he had completely abandoned project design and was teaching most lessons as lectures or worksheet-based activities. In fact, he insisted that New Tech's approach to instruction was not all that different from what he had been doing prior to New Tech adoption:

> Well, the process then was; I mean, really for math, it's the same now as you look at what objectives you need to cover and you try to come up with a logical timeline in progression into what you need to do. Because in math, it's kind of more; it's a lot more linear in the order you're allowed to go because you have to do this before you do that.

So his return to prior practices may have been related to a shallow understanding of what New Tech was asking him to do in the first place. Since he did not perceive it as different from his prior practice, he was not compelled to try to change significantly. He also struggled with negotiating all of his responsibilities and new challenges as a novice teacher.

The demands on teachers' planning time are some of the most significant shifts in practice that the New Tech Network calls for. Teachers are expected to spend a great deal of time designing project ideas, planning scaffolding activities, creating rubrics, and gathering materials from which their students can learn without direct instruction. I observed that this was difficult

for most teachers in the program to successfully accomplish. But it was more difficult for teachers like this novice, who had never planned instruction in a professional setting. In the first and only other year of his teaching career, he had relied on his colleague to provide him with curriculum and lessons, meaning he had virtually no experience creating those instructional components himself. Without clear and specific guidance from New Tech, it is not surprising that he was unable to sustain his enthusiasm for the program.

On the other end of the experience range, several veteran teachers in this study expressed how difficult it was to change their instructional orientation from what they had been doing (often successfully) for years and what New Tech was asking them to do. In fact, they also struggled with a lack of clarity about exactly what and how they were supposed to behave in their classrooms, according to New Tech. All of the teachers at School 2 would be considered "veteran teachers," with over ten years of experience as high school educators. Two of the teachers in the small staff had been teaching for over thirty years. Many of the teachers at the school indicated that these years of experience gave them a unique perspective on how their practice had changed in New Tech. As veterans, they resisted huge leaps from their philosophy of education, and they tended to think of New Tech as offering some useful strategies that they could try out. Despite their honest attempts to fully adopt the model practices, though, all of them struggled with coherent implementation of projects. When they were not sure what to do, they reverted back to past practice.

A veteran humanities teacher with a specialty in English at School 2, for instance, was self-aware about the ways in which his practice had not changed since adopting New Tech. He struggled with this recognition and appeared to want to improve, but he did not know how:

> [Project-based learning is not] the approach necessarily that I had been using previously. I was fond of information. I knew most of the stuff that I would teach backwards and forwards, and so it's kind of different and it's kind of difficult sometimes to sort of let go of that and be the person who's asking questions. And all the time I still do this, it's much easier for me to just tell the kids, "Oh this is what you should do," or, "This is what should happen," all the time. And I don't get corrected on this very often, but I should be asking them, "Well, what do you think you ought to do?" or, "What makes the most sense here?" And sort of guiding them towards steps that if they really use their minds they would come up with on their own.

This teacher represented what I observed many teachers struggling with – changing practice without explicit support or frequent encouragement.

Teachers' prior experiences with using technology also influenced their ability to adopt technology-based instructional practices. Although some teachers had experience using technology in their instruction in various ways, none of them had used technology on a daily basis and as a primary instructional tool, which is what New Tech asks of its teachers. A teacher from School 2, who was among the most familiar with using technology, said that his primary experiences with its use had been as part of a technology-based instructional program before the age of the Internet. He said:

> All you had to do was make a plan, develop a project in which you're going to infuse technology into this unit and teach it however you wanted to. But they would give you money and give you training and so you could buy stuff for the kids in the classroom that they could all be hands on and use and so on. And so I had a couple of really good

projects that I used with 9th graders and 10th graders. And this was in like 1996 and 1997 and 1998, when people were like, oh, what about that Internet?

So, even among those teachers who were familiar with incorporating technology in their classrooms, there were limitations on their ability to fully implement integrated technology practices.

School context and support. There were also individual differences across schools, such that some schools had prior infrastructure that made it more likely that change could occur. When asked whether most of the problems at School 3 were problems that she or that New Tech could solve, Emily said, "It's going to take a village. And it's going to take them being willing to change. So I mean I think that my relationship building there is valuable, but they need to want to change." She went on to say, "Six teachers I think are coachable there; six teachers are damaging children's lives." Unfortunately, I did see evidence that teachers' resistance to adopting New Tech practices influenced the coaching they received.

In one instance, Emily expressed that she had not been able to get through to a teacher at School 3. The teacher wasn't responsive to emails, barely showed up to school, and forced her teaching partner to design and plan all lessons and projects. Clearly, these behaviors were related to individual differences that New Tech had little control over. But Emily began to leave this teacher off of correspondence with her teaching partner, thinking that it was pointless to even try. She said, toward the end of the school year, "It's getting to the point of – I'm not sure what I can do in the last month here." She said her next step with this teacher would probably be just to email her and ask her how things are going. This is a clear example of what I saw repeatedly in New Tech's interventions – the organization erred on the side of inquiry rather than specific descriptions of what the model was and was not. Emily said:

> Therein lies the dilemma for me in this job: how invested do I get in this school in general? Because after I get back from Napa, I essentially have 3 of my 5 days the following week [devoted to School 3]. […] I have a big question mark in my head about: "Is that really how I should be using my time?" I have four other schools. We're in New York with three other schools. I need to be closing out the year with these schools strong and is that the best use of my time? I don't know. So that's something that I am kind of grappling with. But I also really really want good things to happen there.

In struggling with this question, Emily received different messages from her colleagues at New Tech. Her regional coordinator felt that it was "good business to be present," but another colleague, who works closely with coaches, felt that using Emily's time in that manner may not make sense, since the educators at School 3 were not taking advantage of Emily's skills and talents.

The conditions at School 3 were substantially different than those at Schools 1 and 2. As one of the lowest-performing schools in the state, School 3 was required to develop a school improvement plan, and it was awarded a federal school improvement grant in part because of its contract with the New Tech Network. While the teachers in Schools 1 and 2 largely had a choice about whether they would be New Tech teachers, the staff at School 3 was forced into the program by district administration. Only two of the teachers were involved in any New Tech planning prior to the summer training, and this caused many of them to resent the program from the start. Some teachers exhibited no effort to implement New Tech instructional techniques. So, while teachers at School 3 were also influenced by their prior teaching experiences, most of these experiences were within the context of a failing school with unsupportive leadership, seeking an opportunity for turnaround.

For instance, a humanities teacher at School 3, who was also a strong teacher leader and in the running for the New Tech principal's job, described how her teaching partner's lack of investment and training in New Tech put more of a burden on her to do all of the project planning and instruction. He joined the staff after school had already started, since School 3 had staffing problems due to budget turbulence. Of his orientation toward New Tech, she said:

> Well he came in with that attitude—he didn't want to do it. […] So when he came in that first week and a half, he really didn't have anything. He wasn't vested in the project; he didn't know anything about the project, so it was kind of weird. He did sit at the presentation, but he is very much, and he'll tell you this—"I'm very much the guy that if you are going to do this, I will let you."

So this teacher felt as if her ability to fully implement project-based learning was constrained by her partner's lack of interest.

Similarly, a math teacher at School 3 struggled mightily with implementing project-based learning when his teaching partner was disengaged. He admitted that only "15 percent, if that" of his instruction was focused on project-related activities. The rest was practice that he exhibited prior to New Tech – typical high school math pedagogy such as lecture, worksheets, and bookwork. He particularly struggled with having his students work together in teams on project activities:

> Well I really truly don't think that I've been able to facilitate [projects] as well as I should have been able to because I think there should've been more peer collaboration amongst the teams. I started out with teams of four at the beginning of the year and it just got too wild, so I went down to teams of three. I did teams of two, and I should've been

> able to have gotten more students into more of a peer collaboration mode that would've been more suited towards the New Tech model.

Instead, he struggled with team management and discipline concerns. He taught an integrated course, but his co-teacher had a special education background and did not know the math content well. This deficiency led him to take a backseat role to the math teacher, only helping to manage the classroom when students with special needs required his attention.

These teachers, paired with disengaged colleagues, were forced to do the work of project designer, instructor, and manager simultaneously and alone – a difficult task even in the best of cultural situations. But the humanities teacher was sympathetic to teachers who were brought in late to the program. She said, "It was a hard situation all the way around because they didn't—they knew they didn't want to be here. They started someplace else and then they had to come back into it so there was a lot of resentment." She went on to say that it made sense that these late adopters were resistant – all of the early adopters had experienced months of training and gearing up and preparing mentally for transforming their practice, while teachers who were hired or brought back late were forced into a program that they had no knowledge about, and they had not agreed to significantly change.

A humanities teacher at School 3 described how the physical design of her school also limited teachers' ability to change practice:

> But people that know our school know that obviously this is not an ideal setting for New Tech. So it is very difficult with our physical arrangement at the school to be able to do that. I mean we can't really walk around the class, let alone monitor what is going on in each group. So that is hard.

The classrooms at School 3 were not altered in any way since the adoption of New Tech, so they looked much like traditional classrooms. This caused problems in how teachers could physically manage their classrooms. In particular, the several integrated classes at the school, including BioLit, SciTech, and American Studies, enrolled one and half to two times as many students as a traditional high school classroom, so students were often cramped by too many desks, and teachers dealt with discipline problems related to an uncomfortable lack of space. This same teacher also attributed some of her difficulties with implementation to the behavior of her students. She said, "With our student population we slip back a lot, where our scaffolding activities do become mini lessons. Like a lesson, like the daily lesson." She agreed that this meant that some activities that New Tech would like them to pursue often resulted in behavior that looked more like teacher-driven lectures – traditional practice.

Emily, the school development coach at all three schools in this study, attributed some of the lack of change in practice at School 3 to teachers' excuses about the school culture and leadership, rather than real problems that prevented them from adopting New Tech practices. She said, "I think that if they feel supported by the administrator in some way, shape, or form, then they will rise more to the challenge. That's their big thing. They have used [the director] as a way to not do anything." In fact, Emily predicted that, when the new director came on board in the second year, teachers would still invent excuses "grounded in union allowances and instructions" to justify not changing their instructional practices.

Emily was particularly frustrated with those teachers who seemed to use excuses about the school culture or the students in explaining why they hadn't transformed their practices. In describing a conversation she had with one technology teacher in a SciTech class, she said:

> I asked [him] how things are going and he said, "I'm checked out. I'm neglecting the kids. I don't care. I'm being asked to do too many things." Then, I said, "Well what are you trying to do? What type of structures are you guys …" And I said, "I know your admin. is not following through. What are you doing first in your classroom to set up structures and accountability and a foundation to where students know how they're supposed to and expected to do things in your classroom?" "Well I can't do that. Have you seen our kids?" "Well what tech tools have you tried to use?" "Well I can't use those. They're too dangerous. We have 60 kids." Whereas in August, he was super-excited about all the tools he was going to have. So it was just, "I can't do this. I can't do this. I can't do this."

So, even while acknowledging the legitimacy of some of this teacher's complaints, Emily was unsympathetic about how those things might have truly influenced his ability to change. Other teachers at School 3 also wrestled with school culture and student discipline, and problems in those realms discouraged some teachers from feeling as if they could possibly be successful using New Tech practices. A math teacher said,

> I would say the toughest thing for me is not being as successful as I want to be. […] I'm success driven. When my kids are not meeting my expectations, and they don't care to meet my expectations, my expectations mean nothing to them, it's hard. How do we get kids to be motivated?

Emily seemed to permit a certain degree of abandonment of the New Tech approach to instruction when teachers in School 3 struggled with implementation and classroom management. A humanities teacher described how Emily had told her it was acceptable to require specific tasks of students every day throughout a project. She said that Emily encouraged this approach to help with classroom management: "You can still come in our classes and the kids will say, 'Oh

this is our project. This is what we're doing.' They have their groups, their group roles. But every day practically, they have a certain task to do." An example of this strategy was when this teacher had her students log on to Echo to find the project they were working on. In the day's agenda, she would post questions that the students would have to answer. This kind of typical quiz-like activity would not be considered project-based, but it was permitted as a kind of stop-gap between full adoption and complete regression to past practice.

Discussion

Initial findings from the first two years of New Tech implementation indicated that weakly elaborated instructional models can have as many implications for school improvement efforts as highly elaborated models. Evidence from this study suggested that, when educators are told that they need to conduct their practice differently, they seek to understand how they are expected to behave. They draw their own conclusions when there are not elaborated details on which to rely, and, sometimes, they fill in gaps in weakly elaborated models with misconceptions about what is expected of them.

In New Tech, this meant that surface understandings of how instructional practice should change caused some teachers to demonstrate methods that were counter to what New Tech would advise. But, because New Tech avoided extensive elaboration, there were no mechanisms with which to root out misconceptions. So, while teachers often felt empowered to construct their own meaning from the New Tech model, they also often felt unclear about how or why they were failing to reach New Tech's expectations for success.

This study also revealed the extent to which environmental factors can influence teachers' adoption of new instructional methods. When teachers perceived a tension between the goals of New Tech and the goals they had identified in policy or in their own teaching experiences, they

struggled with how to be faithful to both. For many teachers, this negotiation resulted in half-hearted adoption of New Tech practices. Faced with the threat of high stakes tests that could be used to identify weaknesses in their performance, teachers were reluctant to completely give up the practices they believed would improve their students' test scores.

This study provided evidence that the individual and contextual differences between actors and outlets can also influence the degree to which change in practice is possible. When leadership, physical settings, or collegial support was lacking, teachers often struggled to adopt New Tech practices "on their own." This finding indicates a need for school reform organizations to consider the types of settings in which they work and how those settings may require different supports for change.

Important interactions occur between model type and model purpose, such that the purpose of a particular instructional reform may imply the necessary design type for that reform. Project-based learning and technology-based instruction may be highly effective practices for improving student learning and reaching desired educational outcomes, but, if teachers are incapable of learning how to employ these practices fully, their impact is diminished and, ultimately, undermined. Had the practices in New Tech's model been less foreign to its teachers, perhaps Michigan's schools would have exhibited more faithful interpretations of New Tech practice. Instead, most teachers only dabbled in New Tech techniques, and, in turn, their students did not get the full benefit of their powers.

Conclusion

This study provides substantial evidence that the purpose of an instructional reform must inform design for instruction. Without consideration of the demands and novelty of instructional change, reformers risk that their models will be misinterpreted, misapplied, and, eventually,

abandoned for prior practices. As more schools look to externally sponsored models for instructional reform, it is essential to examine the design for that reform and its likelihood to promote systematic and predictable change in practice. Otherwise, schools are likely to invest millions of dollars in the hope that their teachers' practice will positively change, with little reason to believe that those changes will be sustainable or good for students. Instructional models should reflect and take into account the challenges teachers are likely to face in implementing them.

APPENDIX

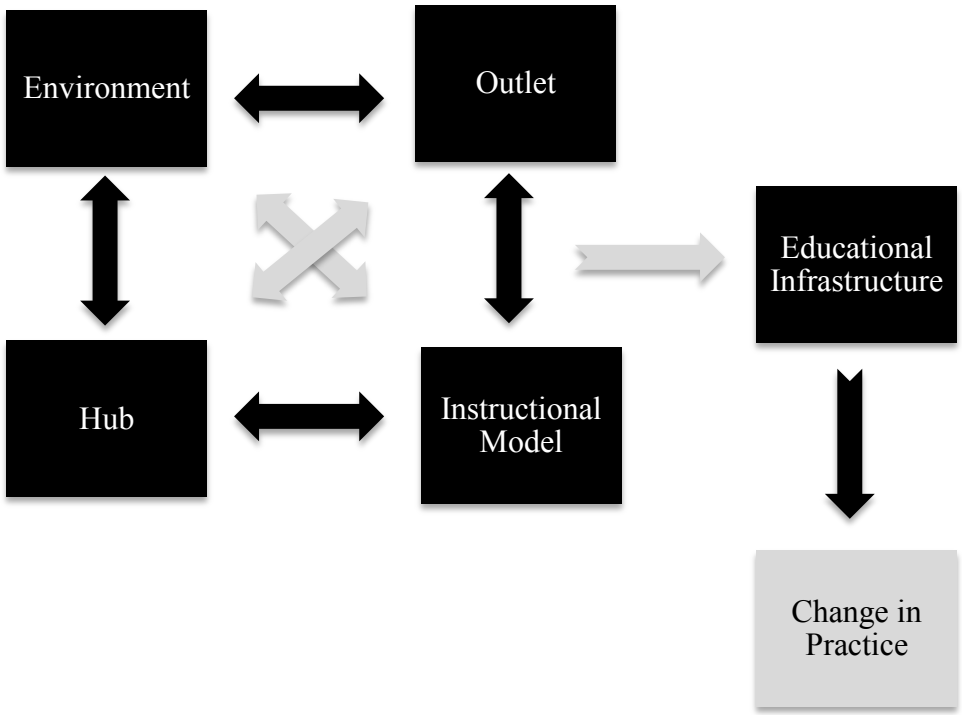

Figure 3. Organizational Dynamics Influencing Change in Practice. This figure illustrates the actors who participate in hub-outlet reform and the result of their efforts. The grey components are the focus of this paper. The interactions between environments, hubs, outlets, and models influence the development of educational infrastructure that is intended to lead to change in practice. This paper examines how those dynamics influence whether and how change in practice actually occurs.

Table 4
Frequency of Codes Used to Analyze Practice in New Tech Schools

Code	Culture Problems	Gaps in New Tech Preparation	Instructional Design	Design Changing or In Flux	Design Differentiation	New Tech Characteristic	New Tech Coaching	Coaching Changing or In Flux	Coaching Differentiation	New Tech Mission	New Tech Requirement	New Tech Structure	Pedagogy Post-New Tech	Pedagogy Pre-New Tech	Principal Variability	School Improvement	Teacher Change	Teacher Not Change	Teacher Variability	Technology	Why New Tech	Totals
Culture Problems		7			1	1							1		6	1		3	3	1		24
Gaps in New Tech Preparation	7		24	1		11	21	1		2		3	13		7	1	1	4	2	3	2	123
Instructional Design		24		3		11	5	1	1	1			20	2			2	6	2	4	5	96
Design Changing or In Flux		1	3		1	1	1	1														9
Design Differentiation	1			1											1							7
New Tech Characteristic	1	11	11	1			4			3		2	4							2	2	55
New Tech Coaching		21	5	1		4		4	1		1		3		1	1		4	1	1		82
Coaching Changing or In Flux		1	1	1			4															12
Coaching Differentiation			1				1															2
New Tech Mission		2	1			3																6
New Tech Requirement							1								1	1						12
New Tech Structure		3				2																9
Pedagogy Post-New Tech	1	13	20			4	3							1	2		9	10	2	4		69

Table 4 (cont'd)

Code	Culture Problems	Gaps in New Tech Preparation	Instructional Design	Design Changing or In Flux	Design Differentiation	New Tech Characteristic	New Tech Coaching	Coaching Changing or In Flux	Coaching Differentiation	New Tech Mission	New Tech Requirement	New Tech Structure	Pedagogy Post-New Tech	Pedagogy Pre-New Tech	Principal Variability	School Improvement	Teacher Change	Teacher Not Change	Teacher Variability	Technology	Why New Tech	Totals
Pedagogy Pre-New Tech			2										1					2	2		1	34
Principal Variability	6	7			1		1				1		2									25
School Improvement	1	1					1				1							3			1	12
Teacher Change		1	2										9						1		1	14
Teacher Not Change	3	4	6				4						10	2		3			7			44
Teacher Variability	3	2	2				1						2	2			1	7				22
Technology	1	3	4			2	1						4								2	18
Why New Tech		2	5			2								1		1	1			2		16
Totals	24	123	96	9	7	55	82	12	2	6	12	9	69	8	25	12	14	44	22	18	16	

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