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I, Janet Brown Walton, hereby submit this original work as part of the requirements for the degree of Doctor of Philosophy in Educational Studies.

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Partners for Change: A Mixed Methods Case Study of an Intermediary-led Partnership for STEM Education Reform

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Partners for Change: A Mixed Methods Case Study of an Intermediary-led Partnership for STEM Education Reform

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by

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Abstract

Cross-sector partnerships have come to the fore as a vehicle for STEM education reform in recent years. Despite the significant investments of resources in such partnerships, little is understood regarding the processes that partnerships use to effect change and, indeed, there is evidence that partnership-led initiatives face numerous challenges that may reduce their effectiveness. This study examined a STEM education partnership led by an intermediary, or third party, organization in a southern state in order to understand how its work created an infrastructure for regional change. A mixed methods case study design was used in which a quantitative survey measuring collaboration was embedded within a primarily qualitative study to understand the characteristics of the partnership and partners’ perspectives on its progress. This research design permitted a more holistic understanding of the partnership’s work by providing a broad perspective on collaboration within the partnership that complemented and enhanced interview findings. A framework of collective impact was used, in which five themes were used to guide the understanding of the partnership’s progress. These five themes – common agenda, shared measurement systems, mutually reinforcing activities, continuous communication, and backbone support – were related to collaboration factors measured in the survey instrument and qualitative and quantitative findings were integrated to create a nuanced description of the partnership’s work. The study revealed that the partnership had made progress in each of the collective impact themes with the exception of shared measurement systems. Findings revealed that the intermediary leadership structure of this partnership coupled with the interdisciplinary backgrounds and strong networking skills of individuals in leadership positions had contributed to its accomplishments. This synergy of organizational structure and individual characteristics was enhanced by the inclusive agenda-setting process used during
partnership initiation and by the strategic use of resources in the partnership. Infrastructure gaps included potentially weak bridging capital among some stakeholder groups in the partnership, lack of public understanding of the partnership’s role in STEM education, and the lack of robust measurement systems within the partnership. These findings have implications for this partnership, and, more broadly, for educational partnerships in general and for STEM education reform. Additionally, this study’s findings have implications for collective impact theory and for the use of mixed methods in studying partnership.

*Keywords: Collective impact, Cross-sector partnerships, Educational partnerships, Intermediary Leadership, STEM education*
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Chapter One: Introduction

In spite of investments in science, technology, engineering, and math (STEM) education, U.S. student performance in STEM subjects continues to flounder. Indeed, U.S. student performance on the Program for International Student Assessment (PISA) continues to lag behind that of other developed nations, and in 2012, U.S. student scores fell below the international average for mathematics and science literacy, showing no improvement over previous years (Kelly et al., 2013). More disheartening news comes from the National Math and Science Initiative (NMSI)’s findings that only 44% of U.S. high school graduates in 2013 were prepared for college level math, and only 36% were prepared for science at the post-secondary level (NMSI, 2014).

Since occupations requiring STEM competencies are predicted to be among the fastest growing in the U.S. (Bureau of Labor Statistics, Employment, 2013; Carnevale, Smith, & Melton, 2011), public attention and rhetoric around creating a pipeline of STEM talent through K-12 education has proliferated in recent years. Diversion of students with demonstrated STEM competency to non-STEM career paths has spawned images of a leaking pipeline, however, and a stunning 75% of STEM capable students choose to pursue non-STEM post-secondary education options (Carnevale et al., 2011). The pipeline continues to leak in post-secondary education, with high rates of attrition in STEM majors and, of those who do graduate with STEM post-secondary credentials, 43% ultimately fail to work in STEM careers due to a combination of factors, including competition for talent from non-STEM industries and work interests and values that are incompatible with STEM careers (Carnevale, et al., 2011).

Technological innovation, a major economic driver, is closely associated with STEM competencies and the nation’s future economic prosperity requires both innovators and the
skilled technicians who play critical roles in bringing innovative ideas to life (Augustine et al., 2010; Rothwell, 2013). The question becomes, then, how do we spark student interest in STEM, encourage competency in the core subjects, and steer talented students into STEM careers? In short, how do we create a STEM-capable workforce for the 21st century and beyond?

Answers to these questions come in the form of a tapestry of STEM programs and initiatives nationwide (National Research Council [NRC], 2013; STEM directory, n.d.; U.S. Government Accountability Office [GAO], 2012). Calls abound for new investments in STEM education (National Science Board [NSB], 2010) and improvements in STEM teaching strategies (National Research Council [NRC], 2012; NSB, 2010). The interested observer can receive daily e-mail summaries of nationwide STEM programs and activities from STEMConnector™, a daily STEM news aggregator that has identified over 3,700 national, state, and local organizations for STEM education and workforce development (STEM directory, n.d.). U.S. News & World Report sponsors an annual national STEM Solutions conference featuring a diversity of speakers, including, in 2013, a NASA astronaut, the Chancellor of University of California - Davis, the U.S. Secretary of Labor, the Human Resources Director for Texas Instruments, and even Miss America (2013 speakers, n.d.). STEM education is clearly a matter of national interest.

Because STEM education has been identified as a critical foundational element for our nation’s future economic prosperity (Augustine et al., 2010), employers, educators, and policymakers have rallied around the cause of improving K-20 STEM education in the U.S. Cross-sector efforts focusing on engaging private sector partners in contextual, regionally relevant educational initiatives to expose students to STEM career paths and bolster interest and enthusiasm in STEM disciplines have proliferated in recent years. One such effort, STEMx, a
self-described grassroots movement, brings together nineteen states to share successful STEM practices and tools. One of STEMx’s goals is to engage partners “across K-12 and higher education, business, government, philanthropy and the community to amplify STEM teaching and learning opportunities for students across the Network and the country” (STEMx, n.d.).

Efforts such as STEMx that convene partners from multiple sectors around social issues are known as cross-sector social partnerships (CSSPs) and are increasingly viewed as vehicles for social change. These partnerships are founded upon agreements by organizations to commit resources to work cooperatively with entities representing different economic sectors (Googins & Rochlin, 2000). Educational reform and workforce development initiatives, in particular, have begun using CSSPs as vehicles to effect change (Austin, 2000; Eddy, 2010; Siegel, 2010), and it is estimated that several hundred thousand cross-sector partnerships between the education and business sectors are in effect (Scales et al., 2005).

The rapid growth in partnerships across social sectors to address societal problems prompted Austin (2000) to label the 21st century “the age of alliances” (p. 1). Indeed, Austin’s predictions of increasing involvement from the corporate and non-profit worlds in effecting social change have been borne out over the past decade and partnerships have proliferated, particularly in the realm of education (Eddy, 2010; Scales et al., 2005). The federal government has joined the call to partnership action in STEM education and invests heavily in initiatives utilizing partnerships. A 2011 survey by the National Science and Technology Council (NSTC) showed that about one half of the $3.4 billion federal investment in STEM education either requires or encourages partnerships (NSTC, 2011). Federal programs and initiatives ranging from the Race to the Top (RTTT) state grant program to the White House initiated Change the Equation (CTEq) coalition rely on engaging the corporate and non-profit sectors with education to improve STEM learning in our nation’s K-12 schools.
Regional CSSPs engaging a variety of stakeholders from the education and private sectors have been a focus of STEM education initiatives in recent years (Eddy, 2010; Johnson, 2012; Siegel, 2010; Why STEM, n.d.). The first statewide STEM education reform effort, the Ohio STEM Learning Network (OSLN) utilized regional partnerships centered around STEM platform schools to drive STEM education innovations in an effort to “align and enrich education, workforce and economic development strategies and resources” (OSLN, n.d., p. 2). This model recently inspired a similar statewide regional partnership model for STEM education improvement in Tennessee, where the RTTT-funded Tennessee STEM Innovation Network (TSIN) relies on regional STEM hubs comprised of partnerships between K-12 schools, post-secondary institutions, businesses, and community organizations (TSIN, n.d.).

To date, however, there is little empirical evidence regarding partnership structures that foster collaboration and enhance progress toward meaningful, long-term-change in STEM education. Johnson’s (2012) study of a regional STEM education partnership in a Midwestern state found substantial structural barriers to change in the form of funding, logistics, and lack of common vision. These findings support the need for a deeper understanding of structures that support successful partnership since, as Bryson, Crosby, Middleton, and Stone (2006) found in their review of CSSP literature, most partnership efforts flounder in the face of such barriers. Indeed, Googins and Rochlin (2000) succinctly stated, “while it might appear that the potential for strategic cross-sector partnerships as a driver of social change is high, there remain a number of fundamental questions that require greater attention from the research and practitioner community” (p. 141). Areas in need of research include ways to understand the complex partner relationships between sectors, identifying processes employed by successful partnerships, and understanding the nature of collaboration within partnerships (Googins & Rochlin, 2000).
A fledgling body of research is emerging to provide a framework for the work of CSSPs and lends insight into some of these questions. In particular, initiatives that harness collective impact, or “the commitment of a group of important actors from different sectors to a common agenda for solving a specific social problem” (Kania & Kramer, 2011, p. 36) appear to be having some success in enacting reform in education and other social sectors through a distinct set of structures and processes oriented toward creating an infrastructure for systemic change (Kania & Kramer, 2011). Collective impact initiatives are distinguished from other collaborative CSSPs by their use of “a centralized infrastructure, a dedicated staff, and a structured process that leads to a common agenda, shared measurement, continuous communication, and mutually reinforcing activities among all participants” (Kania & Kramer, 2011, p. 38) and because of their focus on long-term, systemic change.

A gap in research exists, however, regarding how partnership structure, funding, and level of collaboration affect the creation of sustainable infrastructures for change. These are reasonable and worthwhile areas of investigation since, as Edens and Gilsinan (2005) pointed out, “people of goodwill may be necessary, but they are not a sufficient condition to ensure the creation of viable partnerships” (p. 135), and an understanding of such phenomena has implications for CSSPs seeking social change across the nation (Bryson et al., 2006; Googins & Rochlin, 2000).

**Problem Statement**

In spite of the significant investments being made in educational partnerships, little is understood regarding the complex partnership structures and processes that lead to success. The existing body of evidence indicates that cross-sector collaborative efforts face numerous challenges and frequently fail to meet their objectives (Bryson et al., 2006; Siegel, 2010). While
empirical evidence suggests that partner engagement in terms of perception of mutual and ongoing benefit and involvement are crucial to partnership success and sustainability (Bennett & Thompson, 2011; Hoff, 2002; Rumsey & White, 2009; Seitanidi, Koufopoulos, & Palmer, 2010; Siegel, 2010; Smith & Wohlstetter, 2006), little research has explored how partnership structures and processes provide a foundation from which systemic change can emerge.

Even so, organizations continue to hold out hope for the efficacy of these partnerships, and the federal government continues to award funds to states to engage the business, K-12, and post-secondary education sectors in initiatives to enhance STEM education and bolster career pathways to STEM careers. In fact, the nineteen states receiving federal RTTT funds are charged with forging cross sector partnerships among community partners to “prepare and assist teachers in integrating STEM content across grades and disciplines, [promote] effective and relevant instruction, and [offer] applied learning opportunities for students” (US Department of Education, 2009, p. 4). The chasm between the hopeful expectations for partnership efforts and the all-too-often disappointing reality must be bridged with research that addresses the inherent complexity of working across social and economic sectors and that explores promising partnership practices.

The substantial investments being made in educational partnerships coupled with the scarcity of empirical frameworks to inform partnership formation and operations point to a need to build a stronger base of evidence regarding these partnerships. The existing body of literature regarding educational partnerships contains some indications that situating partnership infrastructure within third parties may support sustainability and effectiveness (Honig, 2004; Johnson, 2012; Kania & Kramer, 2011). There is, however, a gap in research regarding how these partnerships foster change.
The State STEM Change Association (SSCA) was established as part of a federal RTTT grant award in one southern state and, as one of several strategic goals, the SSCA seeks to reduce the STEM talent and skills gap within the state by increasing the numbers of partnerships between business and education. This in-depth case study of one regional branch of the SSCA, the Eastern STEM Change Partnership (ESCP), begins to fill the gap in research by providing first-hand perspectives on the successes and challenges of an intermediary-led partnership.

To date, the body of evidence regarding educational cross-sector partnerships is primarily qualitative. While the complexity of such partnerships certainly warrants qualitative inquiry, the inclusion of quantitative methods permits a broader and more comprehensive understanding of partnership structures and collaboration among a wide swathe of stakeholders, an area of inquiry that is underrepresented in the existing research base. The use of mixed methods therefore contributes not only to the creation of a holistic description of the ESCP’s structure and functions, but also enhances the existing body of literature on educational partnerships by providing an example of the use of mixed methods in examining such entities. Including a quantitative measure of collaboration to complement in-depth partner perspectives allowed a more nuanced understanding of the partnership and revealed dimensions of this partnership that a single approach would have failed to identify.

This exploration of the work of the ESCP in building a partnership to reform STEM education reform revealed factors that can inform this organization’s work and its ability to impact the region’s and state’s STEM economy. Additionally, this study’s findings may have implications for policy makers and other investors in collaborative efforts, and for leaders of similarly structured partnerships.

Purpose
The purpose of this study is to understand how the ESCP, an intermediary-led cross-sector partnership in a southern state, works to create a regional infrastructure for change in STEM education. A mixed methods case study design is used in which quantitative survey data are embedded within an overall qualitative case study. Qualitative data are used to understand the characteristics of the partnership and its work, including its goals and short-term outcomes, and collective impact theory is used to understand partners’ perspectives regarding the partnership’s progress in creating an infrastructure to enact long-term change. Quantitative data, in the form of survey data from the Wilder Collaboration Factors Inventory (Mattesich, Murray-Close, & Monsey, 2001), are used to investigate the level of collaboration, a key element of sustainable partnerships, within the ESCP. The use of multiple data sources to understand the complex nature of an intermediary-led partnership permits a more holistic understanding of the partnership than would be gained by either data source in isolation. In particular, the use of quantitative survey data on collaboration to enrich and complement data on the partnership’s characteristics and progress toward collective impact permits a broad yet nuanced understanding of the partnership’s structure and progress toward creating an infrastructure for change.

Research Questions

The overall question this study seeks to answer is: How does an intermediary-led partnership create an infrastructure for regional change in STEM education? This overarching question is addressed via four research questions:

**Qualitative Questions:**

1) What are the overall characteristics of the partnership?
   
   a) What are the goals of the partnership?
   
   b) How is the partnership structured?
c) What are the partnership’s short-term outcomes?

2) How do partners perceive the partnership’s progress toward creating an infrastructure for change as defined by its progress in the five characteristics of collective impact organizations?

**Quantitative Question:**

3) What is the level of collaboration in the partnership?

   a) How do reported levels of collaboration converge or diverge among stakeholder groups?

**Mixed Methods Question:**

4) How do measures of the level of collaboration enhance understanding of the partnership’s efforts to create an infrastructure for change?

**Worldview**

I believe that research should be led by the problems under investigation rather than by a strict adherence to a methodological school of thought. This pragmatic worldview is particularly appropriate for the investigation of complex phenomena and I adopt Johnson and Onwuegbuzie’s (2004) contingency theory in which circumstances prescribe the mode of inquiry. Rather than the “forced-choice dichotomy between postpositivism and constructivism” (Creswell & Plano Clark, 2011, p. 44), I chose to employ a framework that allowed a broad yet nuanced view of the role of a cross-sector partnership for this study. This mixed methods case study was conducted with a focus on the applicability of research and practicality of findings (Creswell & Plano Clark, 2011).

Pragmatism, according to Johnson and Onwuegbuzie (2004) is a departure from the “traditional dualisms” (p. 16) between quantitative and qualitative schools of research, freeing
the researcher to strategically combine the strengths and weaknesses of quantitative and qualitative methods of inquiry in order to answer research questions. These authors also contended that pragmatism constitutes a practical, results-oriented school of thought that permits researchers to focus on the value of results. This value-oriented, pragmatic worldview is well suited to this study since findings may have implications for partnership organizational and strategic planning, tasks grounded in the practitioner world. Because of my background as the director of a STEM education effort that relied upon partnerships, I bring a unique perspective to this work in terms of first-hand experience with the challenges and opportunities of cross-sector educational partnerships. I have a keen appreciation of the need for research to inform capacity building within partnerships and that explores practices to engage partners in collaborative relationships. Because the current state of inquiry in the collective impact field lies primarily in the practitioner, rather than in the academic sector, this study provided a unique opportunity to move the research base into the academic sector while maintaining its utility to practitioners.

**Definition of Key Terms**

**Terms related to the study design.** The variety of labels and constructs associated with CSSPs can create a confusing playing field for the researcher, and, as Mattessich et al. (2001) admitted, “defining collaboration is made complex by ambiguities in practical usage and scholarly disagreement about the term” (p. 59). Therefore, Mattesich et al.’s rhetorical model was adopted for this work, with the term *collaboration* used to refer to the “dynamic relationship” (p. 5) in partnerships, characterized by mutual benefit, structured relationships, ongoing commitments to mutual goals, shared responsibility, shared resources, and shared accountability for success (Mattesich et al., 2001). Likewise, the terms *partnership* or *collaborative group* indicate the set of organizations involved in the effort (Mattesich et al.,
2001) and partners refers to organizational members of the partnership or individual representatives of those organizations. The term stakeholder refers to an individual or group with a vested interest in the work of the organization in question, although the stakeholder is not necessarily associated with the organization in a formalized manner as are partners. Stakeholder group refers to the social sector that partners or stakeholder represent. In this study, the term partnership refers to the set of partners composing the ESCP, with partners representing one of four stakeholder groups: K-12 education, post-secondary education, business, and non-profit/community groups. Additional stakeholders may include parents and the general public. The term hub is used to denote a regional partnership for STEM education reform and is used interchangeably with ESCP, the name of the organization being investigated in this study (i.e., references to the hub are references to the ESCP).

The term collective impact is used to denote the work of cross-sector partnerships with a social change agenda that are led by an intermediary organization (Kania & Kramer, 2011). These organizations are distinguished from other partnerships with a project-specific focus (Adelman & Taylor, 2003) because of their focus on long-term systemic goals and their use of intermediary leadership (Kania & Kramer, 2011).

Methodological terminology. For the purposes of this study, the term mixed method case study will be used to denote a variant of the embedded mixed method design in which the case “becomes a placeholder” (Creswell & Plano Clark, 2011, p. 95) for collecting multiple strands of data. The term strand is used to denote a line of either qualitative or quantitative research, with the understanding that mixed methods studies employ multiple strands that encompass separate research questions, data collection, and data analyses (Teddlie & Tashakkori, 2009).
Creswell and Plano Clark’s (2011) notation system for mixed methods studies will be used. The term *qual* will be used to indicate the qualitative strand of a study while the term *quan* will be used to denote the quantitative strand. Capital letters will be used to indicate the strand representing the primary methodology used within a mixed methods study; for instance, *QUAL* denotes a primarily qualitative study while *QUAN* denotes a study whose primary emphasis is quantitative. The notation *QUAL*(quan) will be used to indicate a primarily qualitative case study with a quantitative component embedded within the study.

**Delimitations and Limitations**

This study used collective impact theory to examine the ESCP, an intermediary-led STEM education partnership in a southern state, approximately two years into its lifecycle. The unit of analysis was the perspectives of partners and staff members regarding the partnerships’ progress in creating an infrastructure for change. While this partnership may have characteristics typical of cross-sector education partnerships in other geographic areas, its composition and work are specific to the region and organizational structure, and the findings are unique to the particular context in which the partnership is situated. Additionally, this study was conducted just before a critical change in the organization’s funding streams, and the findings reflect the partnership’s work under federal funding and may not apply with altered funding streams.

Collective impact theory was chosen to frame this study due to the focus on this theory by practitioners and its potential for guiding cross-sector partnerships in effecting educational change. The findings of this study may have been different if an alternative framework had been used.

The qualitative portion of this study sought to describe the phenomenon of the partnership’s progress based upon interview data. This data was subject to my personal
interpretation and, while the use of a peer debriefer process addressed bias, it is impossible to remove all researcher bias from qualitative data analysis. Furthermore, although the findings may be informative for partnerships in similar contexts, the findings are not generalizable to a larger population.

**Significance of the Study**

In spite of considerable financial investments by the federal government and a veritable media blitz from both the public and private sectors, improvements in STEM education have been elusive to date (NMSI, 2014). The advent of statewide and regional cross-sector partnerships may provide impetus for change, yet little is understood about factors that support partnership success. The lack of inquiry into such partnerships coupled with large investments in cross-sector partnerships for STEM education reform pointed to the need for this study. Indeed, this investigation begins to lend some insight into heretofore unanswered questions regarding the complexity of partner interactions and the strengths and weaknesses of organizational structures employed in cross-sector partnerships.

Besides informing the work of the ESCP as it plans for the future, this study may provide insight to several groups with interest in STEM education reform, cross-sector partnerships, and mixed methods research. Specifically, this study provides an in-depth perspective into the specific organizational challenges and opportunities experienced by a federally funded cross-sector partnership. The findings may provide insight for policy makers in areas such as challenges to partnership sustainability as they invest public funds into partnership efforts for educational improvement. As increasing numbers of cross-sector partnerships enter the fray of STEM education improvement, leaders of such initiatives may benefit from an understanding of how collective impact theory can lend insight into structures and processes that support their
work, and they may gain insights into the value and challenges of using an intermediary
leadership structure to engage multiple stakeholder groups. Using mixed methods to examine
this partnership may furthermore provide a model to researchers and evaluators charged with
investigating cross-sector partnerships and suggest ways to study relationships and engagement
within such organizations.

This study seeks to contribute to the understanding of cross-sector partnerships for STEM
education reform by investigating how one regional STEM reform effort uses an intermediary-
led partnership structure to create an infrastructure for change. The following chapters will
review the literature base regarding educational partnerships, introduce the theoretical
framework and methods employed in the study, present findings, and, finally, propose
implications and directions for future research in this field.
Chapter Two: Literature Review

This review of literature is organized around understanding the role of partnerships in educational reform efforts. First, the difficulties of enacting reform in the realm of STEM education will be considered. Next, perspectives from literature regarding educational partnerships will be reviewed, including partnership motivating factors, characteristics of successful partnerships and particular challenges that cross-sector social partnerships (CSSPs) for education may encounter. The evidence base for intermediary-led cross-sector partnerships will be considered and, finally, the philosophical and theoretical bases for this study will be discussed.

Findings from this review informed the design of the study. In particular, gaps in the literature suggested the focus on the progress of a cross-sector partnership in effecting change in STEM education. Additionally, findings suggested that organizational structure may significantly impact a partnership’s progress in reaching its goals and prompted the selection of a case using an intermediary leadership structure.

Challenges in Reforming STEM Education

Enacting change in education is undoubtedly a complex business. Fullan (2007) recounted the decades of failed attempts at large-scale educational reform, beginning with the Sputnik-era efforts to improve math and science learning, as an example of the unanticipated complexities of change. He focused on the need for stakeholders at all levels of the change process to find to “see themselves as shareholders with a stake in the success of the system as a whole” (p. 303). The stakes of STEM reform become evident when one considers that our nation’s unemployment rate has hovered between seven and nine percent for the last four years (Bureau of Labor Statistics, 2013). Furthermore, there is evidence of an increasing disconnect
between labor force skills and available jobs, particularly in fields that require STEM
competencies (Carnevale et al., 2011). In spite of the increasingly widespread recognition of the
need for a workforce with STEM competencies (Bureau of Labor Statistics, Employment, 2013)
and the rapid growth of initiatives intended to improve STEM education (NRC, 2012; NSB,
2010; NSTC, 2011), documented change in student outcomes is in short supply. Besides the
scarcity of models for outcomes measurement for STEM reform efforts, a lack of common
definition of STEM and its goals, and the complexities of the local contexts in which reform
efforts are situated create further challenges for STEM education reform.

**Measuring STEM reform outcomes.** While significant investments at the federal level
reflect widespread concern for building a more robust STEM workforce (NSTC, 2011), there is
little agreement regarding ways to measure the effectiveness of STEM education improvement
programs. In spite of this focus on STEM education reform, virtually no academic research has
been conducted on the outcomes of efforts such as Race to the Top (RTTT) funded STEM
initiatives or the statewide initiatives that comprise STEMx. In fact, the initiatives themselves
refer to outcomes only in the most general terms. For instance, the Ohio STEM Learning
Network (OSLN), the oldest of the statewide STEM efforts, provides no outcomes data on its
website, its regional hub websites are similarly devoid of data (OSLN, n.d.). While some of the
regional hubs provide descriptive data such as number of teachers participating in professional
development and even survey results regarding workshop quality (Northwest Ohio, 2013), this
data is not tied to student outcomes or evidence of systemic change.

Initiatives such as the Tennessee STEM Innovation Network (TSIN) and Change the
Equation (CTEq) have recently recognized the need for meaningful outcomes measurements.
The TSIN acknowledges the need for outcome data in its strategic plan, and identifies both direct
and broad metrics for the four goals of its statewide initiative (TSIN, 2012). Its broad metrics include such goals as doubling the numbers of students in STEM activities, demonstrating above-average increases in student performance in STEM schools, increasing student participation in dual enrollment courses, and doubling STEM postsecondary degree attainment by 2018 (TSIN, 2012). Perhaps because the TSIN initiative is yet in its infancy and STEM schools throughout the state are in only their second year of operation, no data correlating to these metrics is publicly available. CTEq acknowledges that while there is an abundance of data regarding poor student performance in STEM subjects and data regarding projected workforce needs, little of this data provides clear guidance on how to strengthen the STEM pipeline (CTEq, 2012). The complexity of evaluating such broad-based efforts becomes apparent in CTEq’s recommendations for public-private data collaborations that integrate data regarding demand and supply of STEM skills, student access to engaging and challenging STEM learning opportunities, effectiveness of STEM educators, and state support of standards implementation (CTEq, 2012). Indeed, CTEq’s Vital Signs data aggregation effort includes state-by-state student math and science scores, post-secondary remediation needs, and teacher preparation data, however these data represent a snapshot in time and are correlated to neither STEM reform efforts or particular programs (CTEq, 2012).

This highlights the difficulty with evaluating STEM education efforts whose ultimate goals are long-term systemic change and workforce impact. There is no evidence that initiatives such as the statewide efforts that comprise STEMx have longitudinal data collection systems in place and, if such systems are implemented, results will not be available for years to come. The complexity in assessing outcomes of widespread reform efforts is exacerbated by the divergent interpretations of the meaning and goals of STEM education, and the complexities introduced by
the local contexts of STEM education reform efforts. These will be discussed in the following sections followed by a review of the challenges of enacting change in education.

**Conceptualizations of STEM.** On its face, the meaning of STEM education is simple: science, technology, engineering, and math education. What this means in practice, however, is far less clear. Breiner, Harkness, Johnson, and Koehler (2012) conducted a survey of faculty at a public university involved in a regional STEM reform effort and concluded that, even in an institution in which faculty were deeply involved with STEM programs, “there is no common operational definition or conceptualization of STEM” (p. 9). Interestingly, over 25% of respondents in the study admitted no understanding of STEM, and 7% of respondents identified STEM as a movement intended to privilege STEM disciplines over the social sciences (Breiner et al., 2012). As Sanders (2009) pointed out, STEM is, indeed, a troublingly ambiguous acronym.

This ambiguity is not confined to institutions of higher education. Sanders (2009) referenced the historical separation of disciplines in K-12 and noted that, “it will take a lot more than a four-letter word to bring them together” (p. 20). In fact, K-12 STEM educators variously conceive of STEM in one of three disparate ways: as *silod*, with STEM as a collection of distinct subject areas with no points of interface; *embedded*, in which real world situations are used to teach a primary disciplinary content with connections to other content areas; or as *integrated*, in which STEM is taught as a single, multi-disciplinary, subject (Roberts & Cantu, 2012). Furthermore, K-12 educators may conceive of STEM education as a broad construct denoting the need to develop 21st century skills, including critical thinking, problem solving, and collaboration (Basham, Koehler, & Israel, 2011).
Although educators disagree on STEM pedagogies and practices (Roberts & Cantu, 2012; Sanders, 2009), policymakers perceive STEM education as a supply mechanism in the workforce development pipeline (U.S. Congress, 2012). Indeed, there is wide agreement that our nation’s economic future relies on technological innovation and a STEM-capable workforce (Augustine et al., 2010; Carnevale et al., 2011; U.S. Congress, 2012; Why STEM, n.d.). Although there are dissenters who argue that economic data fail to support the publicized shortage of STEM workers (Salzman & Lowell, 2007), STEM education rhetoric continues to be driven by economic data and labor market forecasts (Carnevale et al., 2011; Dickman, Scabe, Schmidt, & Henken, 2009). The Change the Equation (CTEq) initiative typifies the workforce rhetoric regarding STEM in its statement that,

STEM learning is an economic imperative. Experts say that technological innovation accounted for almost half of U.S. economic growth over the past 50 years, and almost all of the 30 fastest-growing occupations in the next decade will require at least some background in STEM (Why STEM, n.d.).

The lack of agreement in education and policy circles regarding what exactly this STEM learning comprises highlights the difficulties in creating and enacting programs that simultaneously meet the needs of the educational and private sectors.

To further complicate matters, there are efforts underway to expand the disciplinary content of STEM. For instance, an increasingly publicized movement seeks to add art as a fifth STEM discipline, changing the acronym to STEAM (Miller & Knezek, 2013; What is STEAM?, n.d.). Proponents of STEAM argue that art and design have the potential to transform the nation’s economy along with technological innovation (What is STEAM?, n.d.). Likewise, some
educators and researchers have begun to add medicine as an additional disciplinary in STEM, resulting in references to STEMM education (Miller & Kimmel, 2012).

The divergent stakeholder conceptions of STEM education create a confusing playing field for STEM reform. Indeed, if practitioners and researchers are unable to reach a consensus regarding what STEM education is (Breiner et al., 2012) or how it manifests itself in teaching practices (Roberts & Cantu, 2012; Sanders, 2009), efforts to enact meaningful change will almost certainly be confounded.

**Context of STEM education.** The relegation of educational authority in the U.S. to the state and local levels creates a complex and fragmented playing field for educational reform efforts in general (Darling-Hammond, 2010). STEM education is particularly sensitive to local and regional contexts because of the workforce development policy goals and the role of business and community partnerships associated with STEM education (Dickman et al., 2009; Johnson, 2012; Symonds, Schwartz, & Ferguson, 2011). Even systemic STEM reform efforts, therefore, defer to regional and local contexts as individual localities and regions attempt to respond to the needs of local labor markets and find meaningful ways to forge partnerships with private sector industries (Design principles, n.d.).

Few frameworks exist to guide schools and districts as they attempt to prepare students for both college and careers (Symonds et al., 2011). Two major federal STEM initiatives, CTEq and the RTTT grant program, focus on private sector partnerships with schools (U.S. Department of Education [DOE], 2009; Why STEM, n.d.). RTTT includes STEM partnerships as a competitive priority for applicants (DOE, 2009), while CTEq is an initiative launched by the White House to form a non-profit organization led by corporate executives with the goal of improving the quality of STEM education (Design principles, n.d.) The only specific partnership
guidance within those programs, however, comes in the form of a set of overarching principles for corporate investment in STEM programs provided by the CTEq program (Design principles, n.d.). Additionally, it should be noted that, of these programs, only the RTTT partnerships are supported by federal funding. Since RTTT funds are administered via grants, partnership-building funds will expire, and long-term sustainability must be independent of federal monies.

The results of such ambiguous policy frameworks are exhibited in Mitra and Halabi’s (2012) comparative case studies of three rust belt school systems. The researchers identified a paradox in K-12 educational policy at the local level in terms of career and academic preparation. Their study revealed conflicting policy goals that were particularly manifested in programs intended to either encourage students to pursue post-secondary education or to encourage students to develop skills relevant to regional jobs in order to build the local workforce (Mitra & Halabi, 2012). The findings suggest that students received mixed signals as policies promoted pursuing broad career goals yet simultaneously encouraged students to pursue regionally relevant workplace skills. STEM education efforts that focus on local workforce needs may be subject to this paradox and this phenomenon could contribute to a lack of clarity in goals for students and educators.

Furthermore, local contexts in the form of district policies may hamper well-intentioned reform efforts due to a lack of what Fullan (2007) called tri-level engagement, or system-wide change that permeates the national, state, and local levels. Johnson’s (2013) theory of educational turbulence lends further insight into the difficulties associated with local contexts and their dissonance with larger reform efforts. Johnson conducted a grounded theory analysis of a five-year study of a professional development program for science instruction in an urban school district. This reform-oriented initiative was ultimately hampered in its effectiveness by
school and district policies that interfered with teacher implementation of instructional practices. Spurred by the need to bolster student standardized test scores, district administrators mandated an increase in instructional time for core subjects, resulting in the virtual elimination of science instruction in schools. Johnson concluded that “federally mandated accountability coupled with state-level control of standards and assessments have created a perfect storm to derail the ultimate goal of federal policy: educational reform” (p. 713). She noted dissonance between macro-level, or federal, policy and micro-level, or state and local policies, resulting in an environment that “made the full implementation of the reform extremely challenging” (Johnson, 2013, p. 715).

The “reduction of curriculum to test prep” (Darling-Hammond, 2010, p. 72) can mean that disciplines unrepresented on state mandated tests, including science, technology, and engineering, may be virtually eliminated from the school curriculum at the local level (Johnson, 2013). Such unintended consequences are significant barriers to achieving the desired results of well-intentioned reform efforts (Darling-Hammond, 2010; Johnson, 2013) and introduce additional complexity into STEM education reform efforts. In sum, Johnson’s (2013) findings foreshadow the difficulties in reforming STEM education in complex environments where, at worst, as many as three of the four component STEM disciplines may be excluded from instruction.

**Conclusion: Challenges in reforming STEM education.** The complexities of enacting and measuring STEM education reform coupled with the ambiguities in public and education sector understandings of STEM education noted in this section formed the basis for the current study. A plethora of STEM reform initiatives exist, yet little research exists regarding how these initiatives do their work and whether they are effective. This study was conceived to begin to
understand how one such initiative sought to effect systemic change by understanding the initiative’s strategies for enacting change and how various stakeholders conceptualized the goals and processes of the effort.

**Educational Partnerships**

In spite of the difficulties with reforming STEM education and the challenges in forming partnerships across social sectors (Bryson et al., 2006), partnership-based efforts to enact systemic change in STEM education have proliferated in recent years (CTEq, n.d.; NSTC, 2011; STEMx, n.d.). As Siegel (2010) contended, educational reform efforts are, “by definition and character, everyone’s property - community property” (p. 27) and, as such, should be addressed by organizational models that focus on the overlap of common interests. Indeed, research supports the notion that school change, in particular, is best approached at a community-wide level (Fullan, 2006; Johnson, 2012; Shirley, 2009; Warren, 2005), and there are several hundred thousand partnerships between K-12 schools and businesses nationwide (Siegel, 2005).

Reform in STEM education has been particularly reliant on partnerships across sectors, with businesses, K-12 schools, post-secondary educational institutions, and community groups joining the effort to bolster science and technology literacy and workforce readiness among the nation’s students (Austin, 2000; Hills & Hirschorn, 2008; NSTC, 2011; Ramaley, 2002; Rumala, Hiday, Ewool, Emdin, & Scovell, 2011; Why STEM, n.d.). While community engagement is increasingly recognized as a key factor for educational reform (Warren, 2005) the lack of structured guidelines at the local level (Bainer, 1997; Googins & Rochlin, 2000) can stymie these efforts. Clear frameworks for engaging community partners in STEM college and career readiness activities may lend support to efforts to increase STEM literacy for students and facilitate STEM reform efforts.
Given the vastly different institutional structures and missions of schools, corporations, and other community groups (Edens & Gilsinan, 2005; Googins & Rochlin, 2000) and the tendency for partnerships to fail (Bryson et al., 2006), it is reasonable to ask why these entities choose to approach the ill-defined territory of cross-sector partnerships. The following sections will first offer perspectives from literature regarding definitions of partnership followed by a review of motivations for partnership formation, characteristics of successful partnerships, and the particular challenges that such collaborative efforts face. This discussion will focus primarily on the relationship between K-12 schools and the business sector in partnerships, but will also incorporate evidence from the broader base of CSSP literature to represent the diversity of stakeholders who may be involved in STEM education partnerships.

**Cross-sector partnerships** Any discussion of educational partnerships requires a common understanding of what constitutes a partnership across sectors. Bryson et al. (2006) stipulated that cross sector collaboration involves “the linking or sharing of information, resources, activities, and capabilities by organizations in two or more sectors to achieve jointly an outcome that could not be achieved by organizations in one sector separately” (p. 44). Austin (2000) added that CSSPs are distinct from within-sector alliances since partners from different sectors bring with them a diversity of institutional cultures, performance measures, ways of communicating, motivations, decision-making styles, and personal skills. Siegel (2010) stipulated that CSSPs are comprised of partnerships at the level of organizational leadership, are oriented toward addressing a social problem, and are distinct from alliances between individuals or sub-groups within organizations. Siegel reiterated Bryson et al.’s claim that CSSPs are formed in response to issues that no individual partner or sector can address effectively on its own. The common focus a larger good, or creating a “win-win situation” (Eddy, 2010, p. viii)
distinguishes CSSPs from intra-sectoral and project-oriented partnerships (Adelman & Taylor, 2003).

The relationships within CSSPs can take a number of different forms and may change over time (Austin, 2000). Accordingly, Googins and Rochlin (2000) commented upon the seemingly limitless forms that partnerships can take and noted that most of the relationships between schools and businesses classified as partnerships “are about a one-way transfer of resources – i.e., a corporate benefactor provides some dollars and used supplies…As such, this does not appear to satisfy the intuitive conditions of ‘true partnership’ between the sectors” (p. 132). Austin (2000) attempted to define the array of partnerships by providing a continuum of partnership characteristics that classifies partnerships and their evolution in one of three ways: *philanthropic*, with an uneven resource exchange and minimal expectations for outcomes; *transactional*, characterized by some missional overlap and personal connections at the organizational leadership level; and *integrative*, featuring shared values, mutual benefit, active learning, and staff dedicated to managing the partnership relationship (Austin, 2000). Although Austin noted that not all partnerships must reach the integrative level, he emphasized that a partnership’s place on this continuum should be the result of intentional choices and planning by partners. Seitanidi and Ryan (2007) provided a similar classification model for private sector engagement with non-profits or governmental entities, however they use the term *partnership* to denote a relationship with the typical characteristics of CSSPs, stipulating that partnerships address social issues, that they require active involvement from partners, and require more than a monetary exchange (Seitanidi & Ryan, 2007). These authors classified cross-sector transactions that fail to meet these requirements as philanthropy, benefaction, sponsorship, or cause related marketing.
For the purposes of this review, the term *partnership* will be used interchangeably with the term *CSSP* and will denote a relationship that encompasses the various definitions provided above. Partnerships, therefore, are relationships formed between social sectors to address social problems that cannot be adequately solved by a single sector or partner. These relationships involve some sharing of resources in the interest of a common goal and may represent any point on Austin’s (2000) continuum of alliances.

**Motivations for partnership formation.** Besides the recognition of a larger social issue, there must be some motivation for partners to devote time and resources to partnership endeavors (Googins & Rochlin, 2000). While Seitanidi, et al. (2010) pointed out the divergence of motives for partnering across sectors, they also argued that an examination of each partner’s motives may reveal insights into collective common commitment to the partnership's mission. An examination of motives can indicate the “transformative intention” (Seitanidi et al., 2010, p. 153) of partners with a focus on the extent to which partners are committed to the change process. In order for partners to remain actively engaged over time, a partnership must hold intrinsic value for all parties involved (Austin, 2000; Googins & Rochlin, 2000) and therefore it is useful to examine the motives and expectations of this value on the part of both school and private sector partners, with the recognition that these motivations may be influenced by public policy provisions (Cappelli, Shapiro, & Shumanis, 1998; Johnson, 2010; Longoria, 1999).

**K-12 education sector motivations.** Five qualitative studies specifically investigated the motives of schools as partners in collaborative relationships with businesses and other community organizations. Findings suggest that schools are motivated to collaborate with private sector partners by the need for supplemental resources to meet student needs (Abowitz, 2000; Hands, 2005; Hands, 2009; Bennett & Thompson, 2011; Smith & Wohlstetter, 2006) and a
commitment to community building and the wish to enhance school reputation (Bennett & Thompson, 2011; Hands, 2009; Smith & Wholstetter, 2006).

In an era of decreasing public funding, schools turn to outside partners to supplement school budgets by providing financial and human resources. Case studies indicate that school districts rely on the infusion of private sector funds to mitigate budget shortfalls and value private-sector support in the school budget decision-making process (Bennett & Thompson, 2011; Smith & Wholstetter, 2006). Besides providing political support in the school budget process, partnerships can provide human resources in the form of volunteers for a variety of school functions (Smith & Wholstetter, 2006). Student needs were particularly noted as a motivator by Hands (2005 and 2009), and her findings suggest that teachers and administrators are willing to turn to the private sector to forge partnerships to arrange student work opportunities and provide students with opportunities to interact with employers and other community members in order to develop social skills needed for the workplace. Teachers interviewed by Abowitz (2000) suggested that students in one high school partnership were academically motivated by the work-based opportunities provided by corporate partners, motivating school staff to collaborate with area employers.

Schools occupy a critical, visible space in a community, and school officials recognize that school partnerships provide an opportunity to build and enhance social capital in the community at large. (Bennett & Thompson, 2011). According to Putnam (1995) social capital includes “features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit” (Putnam, 1995, p. 66). The desire to build social capital was echoed by Hands (2009), who found in her case study of two Ontario schools that partnerships contributed substantially to feelings of connectedness between community
members and schools. Similarly, school officials wishing to bolster their school’s public image may be motivated to forge partnerships with area businesses and other community entities (Hands, 2009; Smith & Wohlstetter, 2006).

**Business sector motivations.** In 2007, a national survey reported that 67% of schools received goods and services from individual businesses, while 46% were the recipients of corporate expertise, and 52% hosted volunteers from the business sector (De Havilland, 2007). This data indicates that businesses wish to do more than write checks to schools. Businesses partner with schools for a variety of reasons ranging from fulfilling internal business needs to altruism, and most business partners report that collaborative activities and corporate philanthropy result from a combination of these factors (Guthrie, Arum, Roksa, & Damaske, 2008; Rumsey & White, 2009).

Motivations for businesses to partner with schools have been treated somewhat more extensively by academic researchers than have the K-12 education sector’s motivations for partnering. Three quantitative studies investigated business motivations for partnering with schools and other forms of corporate philanthropy (Cappelli et al., 1998; Guthrie, et al., 2008; Longoria, 1999). A total of six studies using qualitative methods had findings related to business motivations for participating in cross-sector collaborations (Bartlett, Frederick, Gulbransen, & Murillo, 2002; Edens & Gilsinan, 2005; Hoff, 2002; Rumsey & White, 2009; Seitanidi, et al., 2010; Siegel, 2007).

Both Guthrie et al. (2008) and Hoff (2002) investigated tax incentives as a motivator for businesses to engage in corporate philanthropy and partner with schools. Guthrie et al.’s analysis of national scale data regarding corporate and community ties confirmed a strong positive correlation between state corporate tax rates and corporate giving to schools. The researchers
furthermore found that unionized companies and those with institutionalized corporate philanthropy practices give more to schools. However, Hoff found in her survey of Atlanta, Georgia partnerships that 90% of business respondents rated the motive of “reducing tax obligation” (p. 70) as of little or no importance in their motivations for working with schools, while other, more altruistic factors emerged as the key motivators for businesses forming partnerships with schools.

Hoff’s (2002) findings indicated that “building community good will” (p. 70) was the primary private sector motivator for collaborating with schools. The belief that involvement with schools raises public visibility of businesses and generally enhances the social capital of a community is echoed in several other case studies of partnerships (Bartlett et al., 2002; Edens & Gilsinan, 2005; Longoria, 1999; Seitanidi et al., 2010). Some corporate partners indicated, in a case study of North Carolina schools (Bartlett et al., 2002) and in Hoff’s (2002) survey, that their involvement with schools enhanced the public perception of school quality, which, in turn, assisted economic developers in attracting new businesses, a highly skilled workforce, and capital investment to an area.

Student and school needs were also found to motivate business partners. Three studies specifically noted that corporate players have an overarching idealistic wish to help students and schools through corporate philanthropy (Edens & Gilsinan, 2005; Guthrie et al., 2008; Seitanidi et al., 2010). Notably, however, each of these studies also identified other motivations that aligned with internal corporate goals, including product placement (Edens & Gilsinan, 2005), reputation (Seitanidi et al., 2010) and tax incentives (Guthrie et al., 2008) as equally important in corporations’ decisions to form partnerships.
Future workforce needs may also play a key role in motivating business involvement with schools. Cappelli, et al. (1998) used an analysis of data from the National Employer Survey to assess the extent of employer involvement in school-to-work partnerships with schools and found that employers were more likely to engage in partnerships in periods characterized by tight labor markets because of the urgent need to develop a local workforce. Similarly, business representatives in three case studies of school-business partnerships reported that developing a workforce for the future motivated their involvement in a partnership with schools (Hoff, 2002; Johnson, 2012; Siegel, 2007).

Demographic factors were noted as a predictor of distribution of partnerships in Longoria’s (1999) statistical analysis relating partnerships to school characteristics, suggesting that a variety of non-need based factors can contribute to a corporate-level decision to partner with schools. Specifically, he found that proximity of the school to a business, the number of employee’s children enrolled at a school, and the desire to work with a cooperative school principal all influenced the likelihood that a business would partner with a school (Longoria, 1999).

Public policy influences. The 1994 School-to-Work-Opportunities Act (STWOA) had the goal of extending workplace learning to all students by promoting significant school-business linkages (Crowson, Wong, & Aypay, 2000). While funding for this act expired in 2001, other federal and state level programs provide financial support for the formation of school-business partnerships (Crowson et al., 2000; Johnson, 2012; NSTC, 2011). Three studies found that public funding provided an impetus for partnership formation (Cappelli et al., 1998; Longoria, 1999; Johnson, 2012). While each of these studies noted other motivating factors for schools
and businesses to partner, it is not clear that the partnerships would have been forged in the absence of government funding.

Discussion: Motivations for partnership formation. Schools’ and businesses’ motivations for forming partnerships reflect their divergent institutional goals, yet there are some core commonalities between sectoral interests. Both schools and businesses have vested financial interests in partnerships, driven either by internal institutional factors (Bennett & Thompson, 2011; Guthrie et al., 2008; Hoff, 2002; Smith & Wholstetter, 2006) or by legislative mandates that provide funding to partnering organizations (Cappelli et al., 1998; Longoria, 1999; Johnson, 2012). Furthermore, schools and businesses alike wish to build community capacity by enhancing social capital formation and public perception of school quality (Bartlett et al., 2002; Bennett & Thompson 2011; Edens & Gilsinan, 2005; Hands, 2009; Hoff, 2002; Longoria, 1999; Seitanidi et al., 2010).

While motivations for partnering overlap in many areas, it is important to note that the impetus to partner is driven by internal needs of institutions and that these needs diverge across sectors. This finding prompted the inclusion in this study of an investigation into divergences and convergences of collaboration level among various stakeholder groups. In particular, the decision to analyze collaboration survey results along stakeholder group lines resulted from evidence in the literature regarding divergent partner motivations and the potential effect of this phenomenon on partner engagement.

Characteristics of successful partnerships. As Edens and Gilsinan (2005) pointed out, “people of goodwill may be necessary, but they are not a sufficient condition to ensure the creation of viable partnerships” (p. 135). What, then, defines a successful collaborative effort between a school and private sector partners? DeHavilland Associates (2007) pointed to the lack
of extant research into the structure of community and school partnerships. Johnson (2012) provided a unique perspective into an educational partnership by applying a theory of educational change (Fullan, 2006) to a fledgling regional STEM reform effort. After a review of this study’s findings, literature regarding definitions of success for partnerships and organizational characteristics associated with success will be discussed.

**Application of Fullan’s (2006) change theory to an educational partnership.** Fullan (2006) addressed the complexity of educational change by offering a framework for successful change. He proposed that meaningful educational change requires a critical combination of the following: a) motivation to change; b) capacity building with a focus on results, c) learning in context (stakeholders learning new strategies or behaviors in the context of the reform); d) changing the larger context; e) reflective action (changed beliefs emerging as a result of changed behavior); f) tri-level engagement (engagement of local and community, district, and state and national levels); and g) persistence and flexibility during the change process.

Johnson (2012) applied Fullan’s (2006) change framework in a case study of a STEM education reform effort enacted through a regional partnership. Her findings illustrate the difficulties associated with partnership-based change efforts. The regional STEM effort fell short of success in several of the Fullan’s change premises, and Johnson found a decline in collective motivation corresponding to declines in resource availability, challenges to capacity-building resulting from lack of leadership and infrastructure, and a lack of a common vision. Johnson’s findings highlight the need for sustainable funding, clear leadership, and agreement upon common goals in reform efforts and her study made a unique contribution to STEM education reform literature in its application of change theory.
While Johnson urged further research regarding the role of partnerships for sustainable STEM reform efforts, the evidence base to date indicates that such research has not been undertaken. Additionally, while this study lends substantial insight to the progress and processes of the STEM partnership, it was conducted in the early stages of the effort and does not focus on the ultimate outcomes of this partnership’s work.

**Definitions of success.** While the measures used to define success by partnerships are closely tied to partners’ initial motivations for collaborating, the literature reveals nuanced differences in the motives that bring partners together and in the accomplishments that sustain partner interest in the effort. A lack of clarity regarding measures of successful partnership operation is prevalent in the literature and, indeed, DeHavilland Associates’ (2007) national survey of 768 school/community partnerships reveals that only 38.8% of partnerships track outcomes. Ten qualitative studies (Bennett & Thompson, 2011; Edens & Gilsinan, 2005; Hands, 2009; Hoff, 2002; Johnson, 2012; Neumark, 2005; Neumark & Rothstein, 2006; Rumsey & White, 2009; Seitanidi et al., 2010; Siegel, 2007) and two mixed methods studies (Nowell & Foster-Fishman, 2011; Scales et al., 2005) reveal characteristics that partnerships use to define success. Among the findings, several themes emerge regarding partner perceptions of success. A sense of reciprocity and mutual benefit, student outcomes, and organizational capacity building were among the indicators that partners identified as indicating success of their partnerships.

**Reciprocity and mutual benefit.** A one-way transfer of resources among partners can “erode the dominant benefit provider’s motivation to continue investing in the relationship” (Austin, 2000, p. 113). Indeed, the six studies that identified reciprocity of relationship as an indicator of success, point to the continuity of benefits to partners as a factor that maintains their
interest in partnership participation (Bennett & Thompson, 2011; Hoff, 2002; Rumsey & White, 2009; Seitanidi et al., 2010; Siegel et al., 2007; Smith & Wohlstetter, 2006).

Two of the school principals interviewed in Bennett and Thompson’s (2011) case study believed that part of their role in partnerships was to ensure that the reciprocity of benefit was maintained. The principals indicated their belief that deliberate efforts to support business partners built trust and ultimately supported the sustainability of partnerships. Efforts to provide benefits to partners included offering school facilities for business functions and publicly recognizing private sector partners. Similarly, Siegel (2007) stressed that mutual recognition of partner contributions and explicit efforts to show appreciation for contributions was critical to the maintenance of the postsecondary access cross-sector partnership he studied. Likewise, in Smith and Wohlstetter’s (2006) case study of 22 schools in ten states, all partners interviewed identified the exchange of resources as a key factor defining success.

Seitanidi et al. (2010) contended that the notion of mutual benefit in a partnership is the basis upon which successful and sustainable partnerships are founded, and indicated that any non-profit involved in a partnership with a for-profit organization must “go beyond simply seeing the relationship as one of income generation within traditional corporate philanthropy and instead view the potential relationship as having long-term value” (Seitanidi et al., 2010, p. 156). This belief is echoed by the 327 Atlanta-area partners surveyed in Hoff’s (2002) study. Rumsey and White (2009) pointed out that, while a sense of benefit led to higher satisfaction among partners, the self-interest of partners does not “preclude a genuine desire to serve community needs” (p. 303).

Student outcomes. Not surprisingly, improving student outcomes is a primary objective of most partnerships between schools and the private sector (Abowitz, 2000; Hands, 2005). Two
qualitative studies (Hands, 2009; Neumark 2005), one quantitative study (Neumark and Rothstein, 2006) and one mixed methods study (Scales et al., 2005) addressed student outcomes as an indicator of school-business partnerships’ successes. Student outcomes are variously defined as student opportunities for employment (Hands, 2009), likelihood of pursuing post-secondary education (Neumark & Rothstein, 2006), and degree of student participation in partnership activities (Neumark, 2005; Scales et al., 2005).

School-to-work initiatives have as their ultimate goal student transitions to post-secondary education and the labor market and rely on “partnerships between businesses and schools in a way that connects students to work and changes school curricula” (Longoria, 1999, p. 326). These partnerships, therefore, may define success as student opportunities for jobs, internships, or apprenticeships or as successful transitions to post-secondary education. Hands (2009) noted in her study that teachers and partners reported success based upon student employment and noted that “students’ positional access to resources had changed as a result of the partnerships” (p. 202). Neumark and Rothstein (2006) used the National Longitudinal Study of Youth to gauge the effectiveness of school-to-career activities that resulted from the 1994 federal School-to-Work Opportunities Act. They found that while some partnership-based programs, such as student enterprise, co-ops, internships and apprenticeships appeared to bolster overall student enrollment in post-secondary education and employment, these findings did not translate equally to disadvantaged populations (Neumark & Rothstein 2006).

Student participation in programs is easily measurable and therefore, Neumark (2005) found that subjects in his case study of 57 California school to work partnerships used participation as a measure of success preferentially to post-secondary experience measures. Scales et al. (2005) also used participation measures as an indicator of partnership success at one
urban Texas high school. Their findings suggest that the school’s partnerships increased opportunities for students, and that intensity of participation and relational elements of the activities correlated positively with student outcomes (Scales et al., 2005). Specifically, students with high levels of exposure to partnership activities were more likely to earn A’s, and the researchers speculated that students who interacted with adults as part of the partnership activities may have been gotten more benefits than those who participated in activities with less personal contact (Scales et al., 2005).

Organizational capacity-building. CSSPs are formed as vehicles for social change and as such should build partners’ capacity to effect such change (Seitanidi et al., 2010). Three studies examined the extent to which partnerships used organizational capacity for change as an indicator of the effort’s success (Edens & Gilsinan, 2005; Johnson, 2012; Nowell & Foster-Fishman, 2010). In a study of 51 community collaboratives, Nowell and Foster-Fishman (2010) identified four dimensions of growth for organizations along which success can be measured: increases in knowledge, the formation of social capital, provision of expanded opportunities, and resource acquisition. The researchers stressed the importance of establishing feedback loops in partnerships to ensure that partners attend to these success indicators (Nowell & Foster-Fishman, 2010). Similarly, Johnson (2012) identified “lateral capacity building” (p. 51) in which partners embrace the potential for reform as a defining factor in partnership success. Edens and Gilsinan’s (2005) study led them to conclude that success is evidenced by organizational changes that allow for the formation of bridging social capital, which they identified as networks and relationships that effectively span institutional differences.

Organizational characteristics of successful partnerships. Kania and Kramer (2011) identified five characteristics of successful partnerships based upon their case study of a
Cincinnati, Ohio educational collaborative effort. They found that the conditions that contribute to positive partnership outcomes include a common partnership vision, clear and continuous communication, mutually reinforcing activities, shared evaluation systems, and the existence of a support infrastructure. Four of the five characteristics are supported by the studies reviewed while the fifth factor, mutually reinforcing partnership roles, is not explicitly examined in the body of literature reviewed.

*Shared vision.* Kania and Kramer (2011) emphasized the importance of partners acting with a common goal, including “a common understanding of the problem and a joint approach to solving it through agreed upon actions” (p. 39). Five studies identified shared vision and a common planning process as factors contributing to partnership success.

DeHavilland Associates (2007) found that 70% of school administrators reported working collaboratively with partners to set objectives and determine partnership goals. Findings in Bennett and Thompson’s (2011) study suggested that school leaders understand that a new, shared vision should be formulated within the organizational structure of the community partnership. Likewise, Johnson’s (2012) findings indicated that the formulation of a common agenda coupled with “reflective action” (p. 52) is crucial to sustaining a partnership that can effect change. The importance of early planning is evidenced by Seitanidi et al.’s (2010) findings, which suggested that a shared strategic planning process can define long-term partnership success. Similarly, Kania and Kramer (2011) pointed out that each of the many partners in the collaborative they reviewed began the process with somewhat different objectives, and, while disagreements were not eliminated, the initial process of identifying common goals established functional partnerships with all partners agreeing on a set of common objectives.
**Clear and continuous communication.** Kania and Kramer (2011) found that building trust between diverse groups of stakeholders is a “monumental challenge” (p. 40), but that it can be achieved by regular communication sustained over the life of the partnership. Two case studies (Bennett & Thompson, 2011; Bowman & Jackson, 1994) support Kania and Kramer’s findings regarding the need for communication within partnerships.

Bennett and Thompson (2011) reported that weekly meetings between a school superintendent and the chamber of commerce that gave business leaders a voice in the partnership building process resulted in a willingness on the part of local businesses to engage in partnership activities. Similarly, Bowman and Jackson (1994) found that the process of developing a partnership to form a magnet school in Florida was supported by informal communication within the business community that led to high-level partner recruitment as well as by the willingness of school staff to communicate with non-educators regarding school development issues.

**Shared evaluation systems.** As Kania and Kramer (2011) pointed out, having a shared vision “is illusory without agreement on the ways success will be measured and reported” (p. 40). In addition to Kania and Kramer’s findings, two qualitative studies (Neumark, 2005; Honig, 2004), one descriptive study using qualitative and quantitative measures (Hoff, 2002), and one quantitative study (DeHavilland Associates, 2007) addressed partnership evaluation practices.

Hoff’s (2002) study revealed that while 61% of business partners received no partnership feedback, they believed that improved evaluation and feedback would improve the progress of partnership efforts. Similarly, Neumark’s (2005) study found that, while evaluation of partnership activities was necessary in order to improve programs and to inform policymakers about program effectiveness, evaluation efforts in the cases studied was inadequate because of
the lack of consensus about the definition of success, the lack of data collection and reporting, and the lack of control variables used. Neumark’s findings that local partnerships have limited capacities for program evaluation are supported by the DeHavilland Associates (2007) survey results which indicate that there is an overall lack of procedures in most partnerships to monitor results.

There is evidence that some partnerships are able to effectively use evaluation to inform decision-making, however. Honig’s (2004) findings from a comparative case study of four partnerships indicated that knowledge creation in the partnerships was enhanced by intentional review of the results of past decision making. Kania and Kramer (2011) reported that, while evaluating numerous organizations on common measures is difficult, the Cincinnati collaborative they studied has been able to implement a system shared data and common measurements among partners. They offered as an example of success a preschool summer program that was instituted as a result of data collection and reported that the program correlated with a one year increase of 10% in kindergarten readiness scores (Kania & Kramer, 2011).

*Support infrastructure.* A third-party organization, or intermediary, can offer support to partnership functions by providing infrastructure and staff to the partnership.

These intermediary organizations, according to Honig (2004), occupy the space between at least two other parties and primarily function to mediate or manage change in both those parties. These organizations operate independently of these two parties and provide distinct value beyond that which the parties alone would be able to develop or amass themselves (p. 83).

Besides Honig’s case study, one other qualitative study (Kania & Kramer, 2011) and one quantitative study (Longoria, 2009) examined the value of intermediary organizations in
providing supportive infrastructure to partnerships while two qualitative studies (Bennett & Thompson, 2011; Bowman & Dawson-Jackson, 1994) had findings that addressed the need for dedicated partnership staff support.

Honig (2004) and Kania and Kramer (2011) had similar findings regarding intermediary organizations. Both studies found that these organizations can provide vital staff, administrative resources, communication, evaluation tools, and technology resources that individual partners are unable to supply in a concerted and consistent manner (Honig, 2004; Kania & Kramer, 2011). Furthermore, Longoria (1999) proposed that the inequitable distribution of school-business partnerships he identified in his statistical analysis of partnership distributions could be rectified by third party “partnership clearinghouses” (p. 327) that serve to focus resources to deliberately match school and business partners. Interestingly, DeHavilland Associates (2007) found that school administrators indicated that the partners they would most like to build relationships in the future are business coalitions, which could indicate schools’ recognition of the benefits of collective impact.

Even in cases where no intermediary organization exists, dedicated staffing appears to be beneficial to partnership functions. Bowman and Dawson-Jackson (1994) identified a “nucleus” (p. 468) consisting of dedicated staff members around which partnership members and activities revolved and they indicated that the dedicated partnership staff remained a foundational aspect of the partnership function. Echoing this need for staff and supportive infrastructure, Bennett and Thompson (2011) reported that participants in one district’s partnership overwhelmingly reported that the partnership coordinator was essential to the functioning of the partnership.

**Conclusion: Characteristics of successful partnerships.** While the contextual nature of STEM education and workforce development suggests that local problems require local
solutions, potentially useful organizational models can be gleaned from existing literature. The Cincinnati collaborative model described by Kania and Kramer (2011) is a case in point of efforts to scale up recognized successful practices, and nine other cities have formed similar educational initiatives with a focus on leveraging local resources through partnerships utilizing these five organizational characteristics.

A focus on early, shared planning bolstered by effective communication and evaluation of activities appear to be vital factors in success recognized by partnership participants. Additionally, the existence of a supportive infrastructure for the partnership in the form of an intermediary organization or dedicated staff contributes to successful partnership outcomes. Financial support is necessary for this supportive infrastructure, however. Kania and Kramer’s (2011) collective impact model addresses this funding need by engaging a broad base of community partners who may be willing to provide funding.

The importance of organizational structure suggested by these findings prompted this study’s focus on the creation of change infrastructure and the selection of a case using an intermediary leadership structure. Furthermore, findings regarding the increasing practitioner focus on collective impact theory suggested its use as a framework for this study.

**Partnership challenges.** Forming cross-sector alliances is a complex organizational task, and even the most willing partners may face unforeseen challenges in the process of partnership building. As Edens and Gilsinan (2005) pointed out, partnership growth requires organizational change, “but the conditions to be changed only become visible when reflecting on partnerships that did not fulfill their potential” (p. 137). This review revealed a number of the stumbling blocks that partnerships between schools and businesses encounter in their quest to provide meaningful outcomes for students, schools, and employers. Among these stumbling
blocks are an environment of mistrust between partners, differing institutional cultures and practices, and insufficient resources for partnership functions.

**Mistrust.** In spite of the public and private sector enthusiasm for business-education partnerships, there can be an aura of suspicion on the part of schools for business partners whose motives may be perceived to lie primarily in the realm of self-interest. Crowson et al. (2000) referred to the mistrust that can exist between the academic and the corporate worlds and suggested that the effort of forging relationships between schools and the private sector is “bound by a lingering distrust between the key parties of employer, laborer, and professional educator” (p. 247). Two qualitative studies identified this mistrust between schools and businesses and the challenges it can create for partnership building efforts (Abowitz, 2000; Mickelson, 1999).

In her case study of IBM involvement in Charlotte, North Carolina school reform efforts, Mickelson (1999) pointed out that evaluating business motivations for partnering is a complex task and that there is a “blurry line” (p. 500) between self-interest and altruism in business decisions to partner with schools. Her findings included several factors regarding business involvement in education that increased feelings of mistrust and suspicion of private sector partners. She found that business involvement in the school reform effort may have idealized the use of market-based strategies in school settings without providing evaluation of these strategies. Furthermore, she suggested that business contributions to schools may result in a romanticization of corporate culture, deflecting attention from the potential harm that corporate decisions impose on education and the economic well-being of communities. Specifically, Mickelson cited industry negotiations for tax concessions that removed public funding from the community, and corporate site location decisions that may have increased the enrollment burden of already
underfunded schools. Mickelson also pointed to corporations’ lack of public accountability and reported that scrutiny of the Charlotte partnership revealed “that what appeared to be a tidy integration of work, school, and family was a reform initiative shaped to a considerable degree by the strategic interests of a handful of firms” (Mickelson 1999, p. 507).

A case study of a school-business partnership between a Cincinnati, Ohio high school and a group of 100 local employers revealed some mistrust on the part of school administrators (Abowitz, 2000). One administrator characterized corporate partners as “often both dangerously naïve and aggressive” (Abowitz, 2000, p. 335), and the author noted that there was some evidence that corporate partners pursued a school-to-work agenda with an undue emphasis on their own needs. The author went on to note, however, that the partnership evolved over time via inquiry and debate, resulting in a more equitably distributed power structure.

**Institutional cultures and practices.** Schools and businesses operate with substantially different goals, governance structures, constituencies, accountability standards, and decision-making processes. These differing dynamics on the part of partners can “thwart even the most enthusiastic advocates for developing networks” (Edens & Gilsinan, 2005, p. 135). Five qualitative studies investigate the extent to which these institutional differences affect the partnership building process (Abowitz, 2000; Bartlett et al., 2002; Bennett & Thompson, 2011; Edens & Gilsinan, 2005; Johnson, 2012).

Findings from Edens and Gilsinan’s (2005) case study of a school-business partnership suggest that, ironically, the presence of substantial bonds within each of the partner organizations impeded the formation of bridging social capital between the organizations. The researchers found that this ultimately led to the dissolution of the partnership and cited the mismatch between the corporate fiscal year and the school year calendar as a barrier between institutions
that complicated the ability to partner. Additionally, different institutional record keeping practices for the partnership stakeholders complicated financial transactions. Furthermore, the school system’s quest to improve student achievement had resulted in the placement of a number of programs at the school that were not sustained for the long term, resulting in teacher cynicism about the sustainability of new efforts.

A lack of understanding of institutional procedures and practices between partners created frustration in Bennett and Thompson’s (2011) case study. School hiring procedures, volunteer regulations, and business concerns about legal implications of interacting with students all contributed to an environment of tension between chamber of commerce members and school officials (Bennett & Thompson, 2011). Similarly, Johnson (2012) found that collective bargaining conflicts, managerial problems, and bureaucratic requirements also stood in the way of effective partnership operation.

Power differentials between private sector stakeholders and schools can also affect the ability of partners to create a common vision and effectively collaborate. Abowitz’s (2000) findings suggest that the formidable community and financial influence of the industry partners involved in the Cincinnati partnership may have resulted in an industry-based reform agenda that lacked the input of other stakeholders. Bartlett et al. (2002) cited a similar case of business influence in their case study of a Durham, North Carolina school-to-work initiative. They found that the local chamber of commerce used political influence and financial pressure to open an alternative school without stakeholder input regarding the location of the school or the potential of the school to increase racial segregation.

**Insufficient resources.** Cross-sector partnerships require resource commitments, including time and effort as well as money, from all partner organizations (Googins & Rochlin,
Shortages of these resources can cause a partnership to stall and fail to reach its potential. Three qualitative studies (Hands, 2005; Neumark, 2005; Johnson, 2012) and one quantitative study (Sanders, 2001) addressed the problem of resource shortfalls in school-business partnerships.

Funders often prefer to invest in short-term solutions rather than supporting long-term efforts geared toward creating infrastructure for lasting change (Kania & Kramer, 2011) and funding issues can therefore lead to the dissolution of collaborative efforts that require a long-term focus. The propensity for short term funding of partnerships highlights the need for sustainability plans that include ongoing funding mechanisms (Johnson, 2012). Additionally, Johnson (2012) noted that partners in her study competed for the limited resources available to the consortium, and that this competitive atmosphere would likely contribute to the partnership’s failure to achieve its full potential. In Sanders’ (2001) survey of 400 schools across the U.S., 8% of schools noted that funding was an obstacle to partnership efforts, and several schools particularly noted lack of funding as a primary obstacle in forming partnerships. Similarly, Hands (2005) found that the two secondary schools in her case study reported that lack of finances to transport students to partnership-related activities caused difficulty, particularly for rural schools, in forming substantial relationships with partners. Neumark’s (2005) study of partnership evaluation practices revealed that partnerships’ ineffectiveness in evaluating their activities was linked to lack of funding and specific guidelines for data collection and analysis.

Time shortages were also noted as a confounding influence on partnership foundation. Sanders (2001) found that 24% of schools reported difficulty in finding time to identify partners and to conduct partnership activities. Hands’ (2009) findings corroborated this and she found in her case study of two secondary schools that school personnel felt that they had insufficient time.
to establish and maintain relationships with partners. Sanders’ study also revealed that the most reported obstacle to partnership program development was lack of participation, with 30% of schools reporting that this phenomenon interfered with forging partnerships. Respondents noted difficulties in motivating faculty, parents, and other community members to participate in school activities with the community, a finding that may be attributable to time constraints, although intrinsic motivational factors could be a contributor as well.

**Discussion: Partnership challenges.** Partnering across institutional boundaries requires bridging social capital as well as commitments of resources from all partners. The task of engaging partners from multiple stakeholder groups is fraught with complexity, and partners may encounter a number of stumbling blocks in their efforts to effect change and improve student outcomes. An underlying motivation among partners is necessary to form and sustain partnerships and, when this is absent, as Sanders (2001) reported, the task of partner engagement is difficult. Incomplete trust and a suspicion of partner motives can create organizational dissonance in a budding partnership that can eventually lead to failure of the partnership and even community conflict (Mickelson, 1999). Furthermore, scarcity of resources, including inadequate funding, can derail well-intentioned efforts to partner or create difficulties in partnership administration (Johnson, 2012; Neumark, 2005). Similarly, time deficits for forming relationships and carrying out partnership activities can lead to a failure of a partnership to reach its full potential (Hands, 2005). It is reasonable to conclude, therefore, that partners should clearly communicate their goals, willingness to commit resources, and relevant institutional policies at the outset of partnership formation.

**Conclusion: Educational partnerships.** The burgeoning use of partnerships for educational reform (Eddy, 2010; Scales, et al., 2005; STEMx, n.d.) prompted the selection of a
partnership for this case study. In particular, the complexities involved in partnering for educational change revealed in the existing literature suggested that there was a need to investigate the organizational structures and collaborative relationships within such a partnership. The hope was that an understanding of how organizational structures along with partner perceptions of progress would lend insight into ways that partnerships can effectively engage partners and work to overcome the challenges of bringing stakeholders from various sectors together.

**Intermediary-led Partnerships as a Vehicle for STEM Education Reform**

The growing scholarship regarding partnerships reveals that CSSPs face numerous challenges and frequently fail to meet their objectives (Bryson et al., 2006; Siegel, 2010). In spite of this, organizations continue to hold out hope for the efficacy of these partnerships and considerable investments in educational partnerships continue (NSTC, 2011). Initiatives that utilize the distinctive integrative features (Austin, 2000) of collective impact appear to be having some success in addressing educational reform and other social issues (Austin, 2001; Hanley Brown, Kania, & Kramer; 2011; Kania & Kramer, 2013). These initiatives are distinguished from other collaborative CSSPs because of their use of intermediary organizations and focus on systemic change (Kania & Kramer, 2011). Indeed, research into educational partnership efforts supports the notion that intermediary organizations have the potential to institutionalize and sustain reform efforts while providing critical resources to partnerships (Edens & Gilsinan, 2005; Fullan, 2006; Honig, 2004; Johnson, 2012; Kania & Kramer, 2011).

In addition to Honig’s (2004) conceptualization of intermediary organizations as entities that operate independently of partners and add distinct value to the partnership,
Eddy (2010) identified a similar value construct in partnership and used the term *partnership capital* to denote a value that, in sum, supersedes that of individual partners. Intermediary organizations may facilitate the formation of partnership capital by helping partnerships to avoid some of the recognized stumbling blocks in partnership efforts. These stumbling blocks include the challenges inherent in bridging individual partners’ institutional cultures (Edens & Gilsinan, 2005; Fullan, 2007), difficulties in identifying leadership and providing staff for partnership functions (Honig, 2004; Johnson, 2012), and the need to formulate a common vision and strategy (Edens & Gilsinan, 2005; Honig, 2004; Kania & Kramer, 2011).

One of Fullan’s (2007) premises for educational change is the necessity for engagement at multiple levels, including the school/community, district, and state levels. Fullan noted the difficulty of aligning the goals and activities of these stakeholders given their divergent institutional goals and cultures, however he found that “permeable connectivity” (p. 262) is facilitated by “interaction and mutual influence across the three levels” (p. 236). This suggests that intermediary organizations may, by working across the three levels simultaneously, provide a useful framework for such complex interactions. Edens and Gilsinan (2005) echoed Fullan’s points about the difficulties in working across stakeholder groups and attributed the failure of one school-business partnership to the lack of bridging social capital, or networks that effectively span institutional differences. This too suggests that a third party organization may have value in mediating such relationships and providing a needed bridge between stakeholder groups.

Johnson’s (2012) findings suggest that providing institutionalized third party leadership may engender the formation of partnership capital. She noted that building a partnership infrastructure “outside of the establishment of schools, programs, and so forth” (Johnson, 2012, p. 55) can promote partner focus on impact and reduce competition for resources within the
partnership. Furthermore, Johnson’s conclusion that staff and leadership dedicated to partnership functions may facilitate partnership effectiveness is supported by Honig’s (2004) finding that intermediary organizations can provide vital infrastructure and resources that individual partners are unable to provide in a consistent manner. Googins and Rochlin (2000) echoed this focus on partnership structure and process when they stated “it is the strength, character, and duration of the ‘partnering’ process that establishes systems for mutual gain and commitments that merits advocacy” (p. 142).

Much as the lack of common conceptualization of and goals for STEM education can hamper reform efforts (Breiner et al., 2012), a lack of common understanding and vision in partnerships in general can impede partnership work in education (Edens & Gilsinan, 2005; Johnson, 2012; Kania & Kramer, 2011). Intermediary organizations can provide essential scaffolding for such agreements (Honig, 2004; Turner, Merchant, Kania, & Martin, 2012), facilitating “a common understanding of the problem and a joint approach to solving it” (Kania & Kramer, 2011, p. 39). A review of a collective impact CSSP for education revealed that partners joined the initiative with divergent objectives, and, while disagreements were not eliminated, the intermediary organization was able to provide vital assistance in forging a set of common goals (Kania & Kramer, 2011).

Although intermediary-led partnerships should not be considered a magical cure-all for the challenges that plague STEM education reform efforts, this partnership structure has the potential to address a number of difficulties associated with educational partnerships (Edens & Gilsinan, 2005; Honig, 2004; Johnson, 2012). By providing a bridge between stakeholder organizations with divergent internal goals, intermediary organizations have the opportunity to
provide unique support to partnerships as they seek meaningful systemic change in education (Kania & Kramer, 2011; Turner et al., 2012).

**Conclusion:** intermediary-led partnerships for STEM education reform. The existing research regarding the use of intermediary organizations to lead educational partnerships prompted the selection of an intermediary-led partnership for this case study. While the literature base is optimistic regarding the potential of intermediary leadership to provide support and enhance sustainability of partnerships, little academic research has specifically investigated this phenomenon. This study sought to fill this gap in the research by considering the particular role of an intermediary organization and how partners perceive this leadership structure.

**Theoretical Foundation**

Kania and Kramer (2011) coined the term *collective impact* to describe the use of centralized infrastructure and processes in CSSPs to engage partners from multiple sectors in solving defined social problems. Collective impact theory rests on the belief that systemic change relies on coordinated and sustained efforts to build capacity in a field (Kania & Kramer, 2011). Research has revealed that CSSPs displaying five characteristics have the potential to leverage community-wide resources effectively for social change (FSG, 2013; Kania & Kramer, 2011; Turner et al., 2012). These five conditions provide a useful framework for studying the structure and processes of cross-sector collaborative partnerships. The five characteristics of collective impact include: a common agenda; shared measurement; mutually reinforcing activities; continuous communication; and the presence of a backbone, or intermediary, organization (Kania & Kramer, 2011). Figure 1 provides further explanations for each characteristic.
Adelman and Taylor (2003) asserted that collaborative efforts are often hampered by a failure to devote the necessary time to create a foundation on which sustainable action and change can rest. The authors pointed in particular to the need for partners in CSSPs to move beyond project-specific thinking and cited factors including institutionalized support mechanisms, resource allocation, and identification of distinct processes as key components in an infrastructure for change, a phenomenon characterized by sustained and focused effort (Adelman & Taylor, 2003). In this study, the structures and processes associated with successful collective impact organizations are used as a proxy for infrastructure for change as described by Adelman and Taylor.

![The Five Conditions of Collective Impact](image_url)

Collective impact researchers have used this framework to investigate a diversity of CSSPs, including the Strive Partnership for education in Cincinnati, Virginia’s cleanup efforts at the Elizabeth River, and a childhood obesity project in Massachusetts (Hanley Brown, Kania, & Kramer, 2012). FSG, a non-profit firm specializing in consulting and evaluating social impact organizations, conducted an evaluation of six organizations utilizing collective impact as a framework (Turner et al., 2012) and, although no results have been published to date, FSG staff indicated that collective impact theory provided a useful framework for their study of intermediary organizations (A. Bhatt, personal communication, August 9, 2013). Additionally, Daun-Barnett and Lamm (2012) used collective impact as a framework to examine the role of community foundations in establishing local college access networks (LCANs) as part of a larger evaluation of LCANs. It is notable that the state of Michigan identified collective impact as part of its statewide strategy to enhance college access (Daun-Barnett & Lamm, 2012), illustrating the potential for collective impact as a framework for systemic change. Although the collective impact research to date has been primarily situated in the practitioner rather than the academic community and rests primarily upon retrospective analyses of successful initiatives (Daun-Barnett & Lamm, 2012), the tenets of collective impact are supported by findings from academic research including Bryson et al.’s (2006) framework for understanding cross-sector collaboration and Mattesich et al.’s (2001) inventory of collaboration factors. Bryson et al. (2006) proposed a framework for understanding the work of CSSPs based upon a comprehensive review of partnership literature. The authors identified five interactive categories denoting characteristics of CSSPs and issues these partnerships face in addressing complex social problems (see Figure 2). The five categories Bryson et al. identified as areas of consideration to guide inquiry into CSSPs are: a) initial conditions, including environmental
factors and history of relationships; b) process, including strategic planning, leadership, trust-
building, and conflict management; c) structure and governance, including contextual and
organizational factors; d) contingencies and constraints, including the type of collaboration that
occurs, imbalances in partner power, and competition within the CSSP; and e) outcomes and
accountabilities (Bryson et al., 2006). The relationship between these five constructs is iterative
and recursive, and the authors alluded to the complexity inherent in the framework when they
pointed out the “nonlinear quality of many collaborative relationships and endeavors” (Bryson et
al., 2006, p. 45).

Collective impact theory approaches the understanding of CSSPs from the lens of Bryson et al.’s (2006) process and structure/governance categories. The first of the collective impact
tenets, development of a common agenda, falls within Bryson et al.’s process category with its
focus on negotiating agreements regarding goals and establishing leadership. Kania and
Kramer’s (2011) finding that shared measurement systems are an important facet of collective
impact is also in accord with Bryson et al.’s findings that CSSPs that connect data with
accountability are more likely to succeed. Furthermore, collective impact’s emphasis upon
mutually reinforcing activities and continuous communication, align well with Bryson et al.’s
structure and governance component of CSSPs. For example, a factor in partnership
effectiveness is the extent to which partners feel supported and recognized (Kania & Kramer,
2011), and Bryson et al. likewise found that celebrating wins with partners is valuable to
engendering ongoing support for the CSSP.
Although collective impact provides a useful framework for examining a partnership’s potential for success from a structural and procedural perspective, it provides little insight into the phenomenon of collaboration, an important consideration for partnership sustainability and success (Austin, 2000; Eddy, 2010; Googins & Rochlin, 2000). Although the five tenets of collective impact allude to collaborative relationships by introducing concepts such as trust, coordination of activities, and shared goals, the framework falls short of capturing the theoretical
understanding of collaboration provided in Mattesich et al.’s (2001) success factors for collaboration.

Mattesich et al.’s (2001) review of collaboration literature identified a set of factors that influence the success of collaborative relationships and provide a practical way in which to examine collaboration in partnerships. The authors identified a total of 20 factors that are grouped into six broad categories (see Table 1): environment, membership characteristics, process and structure, communication, purpose, and resources. These 20 factors were used as a basis for the Wilder Collaboration Factors Inventory, a survey instrument designed to measure the level of collaboration among partners in a CSSP (Mattesich et al., 2001). Furthermore, the 20 factors can be related to Kania and Kramer’s (2011) characteristics of collective impact. While the collaboration factors bear a relationship to the collective impact constructs, as a whole they do not capture the unique nature of the processes and structures associated with collective impact. Likewise, collective impact as a theory fails to tease out collaboration factors. The complementary nature of the two frameworks is evident in Figure 3, which relates collective impact constructs to associated collaboration success factors to create a theoretical framework for a study of the ESCP.
Table 1

*Mattesich et al.'s (2001) Collaboration Success Factors*

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<thead>
<tr>
<th>Category</th>
<th>Collaboration Success Factors</th>
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<tbody>
<tr>
<td>Environment</td>
<td>• History of collaboration or cooperation in the community</td>
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<td></td>
<td>• Collaborative group seen as a legitimate leader in the community</td>
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<td></td>
<td>• Favorable political and social climate</td>
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<tr>
<td>Membership Characteristics</td>
<td>• Mutual respect, understanding and trust</td>
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<td></td>
<td>• Appropriate cross sector of members</td>
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<td></td>
<td>• Members see collaboration as in their self-interest</td>
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<td></td>
<td>• Ability to compromise</td>
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<tr>
<td>Process and Structure</td>
<td>• Members share a stake in both process and outcome</td>
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<td></td>
<td>• Multiple layers of participation</td>
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<td></td>
<td>• Flexibility</td>
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<td></td>
<td>• Development of clear roles and policy guidelines</td>
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<td></td>
<td>• Adaptability</td>
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<td></td>
<td>• Appropriate pace of development</td>
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<tr>
<td>Communication</td>
<td>• Open and frequent communication</td>
</tr>
<tr>
<td></td>
<td>• Established informal relationships and communication links</td>
</tr>
<tr>
<td>Purpose</td>
<td>• Concrete attainable goals and objectives</td>
</tr>
<tr>
<td></td>
<td>• Shared vision</td>
</tr>
<tr>
<td></td>
<td>• Unique purpose</td>
</tr>
<tr>
<td>Resources</td>
<td>• Sufficient funds, staff, materials, and time</td>
</tr>
<tr>
<td></td>
<td>• Skilled leadership</td>
</tr>
</tbody>
</table>

Although Kania and Kramer’s (2011) collective impact characteristics, Bryson et al.’s (2006) framework for studying collaborative efforts, and Mattesich et al.’s (2001) collaboration success factors each approach the study of CSSPs and collaborative relationships in a unique manner, the underlying concepts extend across the three frameworks, providing support for the theoretical validity of each. This relationship is evident in Table 2 and lends insight into the potential for a bridge between process-oriented practitioner-based research to more theoretically based academic research (Bryson et al., 2006). The Wilder Collaboration Factors Inventory and
Kania and Kramer’s collective impact characteristics suggest tools and methods that can be used to apply current understanding of collective impact to partnerships that utilize intermediary organizations for systemic change (Kania & Kramer, 2011; Turner, et al., 2012).
Figure 3. Theoretical framework for a mixed methods case study of the ESCP.
Table 2

_Relationship Between Frameworks for Understanding CSSPs_

|---------------------------------------------------|---------------------------------------------------------------------------------|-----------------------------------------------|
| Common agenda (Creation of a shared vision for change and agreement on primary goals of initiative) | Process (planning) | • Development of clear roles and policy guidelines  
• Concrete, attainable goals and objectives  
• Shared vision  
• Unique purpose  
• Flexibility |
| Shared measurement (agreement on ways success will be measured and reported) | Outcomes and Accountabilities (results management system) | • Members share a stake in both process and outcomes |
| Mutually reinforcing activities (coordination of partners’ differentiated activities) | Process (agreement on partner roles, planning built on “distinctive competencies of the collaborators” [Bryson et al., p. 48]) Outcomes and Accountabilities (Inputs, processes, outputs) | • Appropriate cross-sector of members  
• Members see collaboration as in their self-interest  
• Ability to compromise  
• Adaptability  
• Appropriate pace of development  
• Multiple layers of participation |
| Continuous communication (trust-building communication, establishment of a common language, and sharing knowledge) | Process (building trust, managing conflict, planning) Contingencies and Constraints (power imbalances, competing institutional logics) | • Mutual respect, understanding, and trust  
• Open and frequent communication  
• Established informal relationships and communication links |
| Backbone support (separate organization and staff with skills to manage and coordinate initiative) | Structure and Governance (structural configuration and governance) Contingencies and Constraints (collaboration type, administrative activities) | • Collaborative group seen as a legitimate leader in the community  
• Sufficient funds, staff, materials, and time  
• Skilled leadership |
In this study, collective impact provides an overall framework to guide a case study investigation of an intermediary-led partnership. Specifically, each of the five characteristics of successful CSSPs formed a theme upon which interview questions were based to gain an understanding of the ESCP’s progress in each of the five areas of collective impact. Research questions one and two (*What are the overall characteristics of the partnership? How do partners perceive the partnership’s progress toward creating an infrastructure for change?*) were informed by the collective impact framework. Mattesich et al.’s (2001) collaboration success factors were used to frame the embedded quantitative portion of this study represented by research question three (*What is the level of collaboration in the partnership?*). Because of the relationship between frameworks, quantitative results were integrated with qualitative findings to gain insights into the relationship between the partnership’s progress in collective impact and partner perceptions of collaboration in answer to research question four (*How do measures of level of collaboration enhance understanding of the partnership’s efforts to create an infrastructure for change?*). Ultimately, this permitted a holistic understanding of the partnership and its potential to enact regional STEM education reform.

**Conclusion**

Regional partnerships between K-12 schools, the business community, and post-secondary education have the potential to act as agents of change in the daunting task of STEM education reform (Eddy, 2010; Honig, 2004; Johnson, 2012). The partnerships themselves, however, face a number of challenges that must be surmounted before they can go about the business of initiating change for students and educators. Indeed, partnership efforts have been known to flounder due to institutional differences (Edens & Gilsinan, 2005), competition for resources (Johnson, 2012) and a lack of clear leadership and common vision (Johnson, 2012;
Kania & Kramer, 2011). Intermediary organizations offer an opportunity to overcome these obstacles by providing a mediating infrastructure that can support the development of collaborative relationships and ultimately leverage collective impact of stakeholders across sectors (Honig, 2004; Kania & Kramer, 2011).

Evidence-based models for structuring and evaluating intermediary-led partnerships are in short supply (Honig, 2004; Kania & Kramer, 2011) and research in this field has the potential to impact future partnership investments and public policy. In particular, studies that move the field of inquiry in this area into the realm of academic research have the potential to impact the understanding and practice of educational partnership formation and function. With this knowledge in hand, policymakers, reform advocates, and stakeholders across sectors have the opportunity to leverage the collective impact of communities to enact meaningful change in STEM education.

The Eastern STEM Change Partnership’s (ESCP) use of dedicated staff to manage its work indicates that it adopts an integrative (Austin, 2000) approach to its partnership work and that it has the potential to engage its partners in the structured long-term work typical of collective impact initiatives (Kania & Kramer, 2011). Although the existing literature contains indications that partnership structure and processes can facilitate the ability of CSSPs to move toward their goals, little academic research has addressed specific examples of how these phenomena operate in the arena of STEM education. An examination of the ESCP, therefore, has the potential to make a unique contribution to the current understanding of the use of partnerships to reform STEM education. In particular, a study of how this partnership creates an infrastructure for change by leveraging the collective impact of partners illuminates benefits and
challenges involved with this model of partnership, and points to areas that merit further attention within the partnership.
Chapter Three: Methods

This study utilized a mixed methods case study approach. Case studies, according to Yin (2009), are suitable for investigating complex phenomena in situations in which the “boundaries between phenomenon and context are not clearly evident” (p. 18) and in which multiple data sources are employed. More specifically, a mixed methods case study design was used in which quantitative data were embedded within a primarily qualitative case study approach. The following sections will include an overview of the study context, a definition of mixed methods research, an overview of the mixed methods case study design, a summary of methodological challenges, and a review of qualitative, quantitative, and mixed methods data collection and analysis.

Context

The setting for this study was the Eastern STEM Change Partnership, or ESCP (pseudonyms are used for all organizations and individuals in order to protect participants’ identities), a regional affiliate of the State STEM Change Association (SSCA), a statewide K-12 STEM education reform organization. The ESCP, headquartered in the city of Eastville, is located in the southeast corner of a southern state and comprises a sixteen-county region. This study was conducted from December 2013 – February 2014.

The SSCA received start-up funding as part of a 2010 Race to the Top (RTTT) award to this southern state and seeks to enact change via a series of regional hubs. The SSCA endeavors to align existing STEM programs and policies and leverage existing assets on a regional level. The SSCA’s strategic plan specifically recognizes that student interest and access to STEM programs are key drivers of change, and adopts a highly collaborative approach to reform. STEM schools and associated educational innovations, teacher training programs, cross-sector
collaborations, and public relations campaigns launched on a region-by-region basis throughout the state are used to accomplish the goal of increasing the number of students seeking STEM post-secondary degrees and careers.

A grant award from the SSCA established the ESCP hub in 2011. The hub identifies three core areas of activity: training educators, engaging partners, and informing the community about STEM. Training educators includes both the hub’s services in providing STEM professional development activities to in-service teachers in the region and providing a repository of resources for teachers on the hub website. The resource repository includes samples of PBL lesson plans, units in use at the STEM school, and links to other websites. Partner engagement includes the hub’s efforts to engage community and business partners to provide teachers and students with STEM activities in regionally relevant contexts. Examples of partner involvement opportunities include sponsoring events, donating equipment, hosting student field trips, and teacher job shadowing opportunities. The ESCP hub undertakes informing the community about the importance of STEM via a public relations campaign that includes a public service announcement broadcast on a local cable television station and proactively seeking publicity via regional media outlets.

The ESCP accomplishes the work in these three areas via a collaborative effort whose leadership is housed at the Regional Foundation for Education (RFE), an intermediary (Honig, 2004) or backbone organization (Kania & Kramer, 2011) that works to leverage community assets in support of education in the southeastern region of the state. Currently, 25% of the RFE’s budget is allocated to STEM education via the ESCP. National corporations, including an Internet retailer, a scientific supply company, and a variety of local and regional businesses and civic organizations contribute to the RFE’s STEM education budget.
Two staff members were hired to lead the hub after the SSCA awarded funds for the ESCP. The Managing Director, Karen Banks, is charged with partnership development, communication with the larger community, securing funds for sustainability, managing budgets and grants, and working with STEM school leadership. The Learning Director’s job responsibilities include organizing professional development programs, cultivating relationships with business partners, and assisting in securing funding for ESCP sustainability. Sheila Woodford holds this position.

The ESCP leverages active community and private sector support. A total of 47 partners, including non-profit civic organizations, health care organizations, industry associations, chambers of commerce, and post-secondary and school district leaders, signed the initial funding proposal for the hub. Organizations cited as partners in the hub’s initial work plan include local education departments, regional local education agencies (LEAs); a community college; the regional campus of the state university; numerous business partners; the regional Chamber of Commerce; a regional manufacturers’ association; and a regional technology economic development organization.

This setting was chosen for this study because of the unique character of the partnership structure. Although there are six hubs in operation within the SSCA, all but the ESCP are housed within either K-12 or post-secondary educational institutions. In fact, the SSCA statewide initiative was modeled upon a similar initiative in a Mid-western state that utilizes regional centers for STEM education reform. In this state, too, leadership of the regional centers lies primarily within K-12 or post-secondary educational institutions. The ESCP, therefore, by situating its leadership within the RFE, provides a unique case of an intermediary-led
partnership, and an understanding of this partnership’s work and structure could have implications for future partnership efforts.

**Mixed Methods Definition**

Drawing upon various definitions of mixed methods research in the methodological literature, I will offer an operational definition that reflects my particular perspective and worldview. I define mixed methods research as a research methodology that is driven by the exigencies of a research question and that rejects the notion that a researcher must situate herself solely within either the quantitative or qualitative research communities. Driven by the research question, mixed methods designs strategically combine quantitative and qualitative methodologies within one study in order to gain a more holistic understanding of the phenomenon under investigation. The quantitative and qualitative research methods can be combined in a variety of ways, both in data collection and analysis, but the essence of mixed methods is to integrate the findings from different methods to more fully understand a phenomenon while leveraging the strengths of each method.

Several published definitions influenced my understanding and the manner in which I define mixed methods research. Johnson and Christensen’s (2008) perspective on this methodology particularly resonates with me because of the focus on research questions and practical considerations reflected in their statement that methods chosen for an investigation “will depend on the research questions and the practical issues facing a researcher” (p. 34). Likewise, Teddlie and Tashakkori’s (2009) reflection that mixed methods is an alternative to the divide between quantitative and qualitative research camps aligns with my beliefs since I do not identify myself firmly with either of those camps. Instead, I intend to adhere to Creswell and
Plano Clark’s (2007) emphasis on the utility of employing a mix of quantitative and qualitative methods in order to gain a holistic understanding of complex phenomena.

**Mixed Methods Case Study Design**

Merriam (2009) described a case study as an investigation of a “contextualized contemporary” (p. 31) phenomenon. Furthermore, according to Hatch (2002), the identification of boundaries or unit of analysis is a crucial component of case study design. In this case, the phenomenon under investigation was an intermediary-led partnership’s progress toward creating an infrastructure for change. The context for the study is the ESCP, a regional partnership for STEM education reform, and the unit of analysis is ESCP partners’ and staff members’ perspectives. The study was bounded in time as well, and data collection took place from December 2013 – February 2014.

Yin (2009) stated that a single-case study approach is warranted in several situations. He provided five rationales for this approach: a) a critical case used to test a theory; b) an extreme or unique case; c) a representative or typical case; d) a revelatory case; and e) a longitudinal case. Because of the uniqueness in this state of the ESCP’s use of an intermediary organization, this case represents a unique case in the context of the SSCA and federally funded STEM education partnerships, justifying the use of a single case study approach.

Besides the choice to use a single case study, several considerations are important in choosing a mixed methods design. The research problem is primary amongst these considerations since it plays a central role in guiding methodological choices in mixed methods research (Creswell & Plano Clark, 2011). Yin (2009) pointed out that utilizing mixed methods research designs in a case study “can permit investigators to address more complicated research questions and collect a richer and stronger array of evidence than can be accomplished by any
single method alone” (p. 63). Creswell and Plano Clark (2011) concurred with Yin’s (2009), Merriam’s (2009), and Hatch’s (2002) description of the case study’s use to investigate complex phenomenon, but also offered a more nuanced description of the use of mixed methods within the case study. These authors contended that the purpose of including a secondary data strand is to answer a different, but related, research question and that the design strand embedded within the larger study context is subservient to the primary approach. In this case study, the use of a survey to collect quantitative data regarding level of collaboration was secondary to the overall qualitative case study of the partnership’s role in creating an infrastructure for change. The survey data served to enhance the overall understanding of the partnership by providing a broad insight into partner’s perspectives on the level of collaboration within the organization. Figure 4 provides a procedural diagram of the study.

Defending the choice of a mixed methods research design is complicated by “the inherent complexity” (Creswell & Plano Clark, 2011, p. 54) of these designs. In order to defend the choice of a mixed methods case study design for this study, therefore, it is appropriate to review the decisions made during the design process in relation to the basic features of the embedded, QUAL (quan) design. Purpose and rationale, timing, and priority will be considered in the following sections while a discussion of integration and inferences will be presented after the discussion of mixed methods data analysis. This section will conclude with a consideration of models of mixed methods case studies in the existing literature and a discussion of challenges of mixed methods case study designs.
Figure 4. Study design diagram for a mixed methods case study of the ESCP.
**Purpose and rationale.** Greene, Caracelli, and Graham (1989) provided five rationales for mixing methods based upon their review of mixed methods evaluations of educational and social programs. These five broad justifications for mixed methods research - triangulation, complementarity, development, initiation, and expansion - are often used in combination and are not an exhaustive list, but rather a framework to guide researcher decision-making (Bryman, 2006). Because the purpose of a study plays a key role in methodological decisions, the purpose and rationales for mixing data are inextricably linked and will be considered together in this section.

The use of multiple data sources in this study facilitated a holistic understanding of the ESCP’s work and progress toward creating an infrastructure for change. While the overall purpose of the study was to understand how this partnership created an infrastructure for change, a secondary, but related goal was to measure the level collaboration within the partnership. The case study approach requires rich, descriptive data gained from qualitative approaches in order “retain the holistic and meaningful characteristics of real-life events” (Yin, 2009, p. 4), and in this case, qualitative data revealed the nature of the partnership and partners’ perspectives through description. At the same time, however, an understanding of collaboration was facilitated by the use of quantitative methods. The quantitative findings enhanced the qualitative and promoted the creation of a more comprehensive and nuanced description of the case than would have been possible using qualitative interview data in isolation. Additionally, since there is a relationship between the constructs measured in the two strands of the study, complementarity, or elaborating, illustrating, and increasing validity of constructs (Greene et al., 1989) was also a purpose for the use of multiple methods in this study.
**Timing.** The temporal relationship of the separate strands of inquiry in a mixed methods study is a key decision point and, as Creswell and Plano Clark (2011) pointed out, it is important to note that timing refers not only to data collection but also to data use. In this study, qualitative and quantitative data were collected and analyzed concurrently in a single phase of the study, a situation that Creswell and Plano Clark label *concurrent timing*. Survey and interview data were analyzed separately and then integrated as a distinct second phase of the case study process. This timing is appropriate since the strands of the study were independent from one another and the concurrent collection of data allowed for an efficient flow of the research process and facilitated a focus on data integration.

**Priority.** Creswell and Plano Clark (2011) defined priority as the “relative importance or weighting of the quantitative and qualitative methods for answering the study’s question” (p. 65). Morse (1991) supported the centrality of the research question in determining priority by pointing out that priority should not be determined by the amount of time or effort required to collect and analyze quantitative or qualitative data, but rather that it should be determined by the “theoretical drive” (p. 121) of the research question.

This study adopted a qualitative priority QUAL(quan) design in which the quantitative survey data was secondary to the overall qualitative case study approach and was used to specifically address the construct of collaboration. This qualitative priority was appropriate because of the emphasis in the study on creating a rich, narrative description of the partnership and partner perspectives on progress. The quantitative strand investigated the phenomenon of collaboration and, while it complemented qualitative interview data, it lacked the depth of the qualitative data and was used primarily to enhance and further understand qualitative findings.
Models of mixed methods case studies. The case study research methodology frequently utilizes multiple methods in attempts to understand contextual phenomena (Yin, 2009) and is therefore particularly appropriate for studies that seek to understand the highly contextual nature of cross-sector partnerships in education. It is important to note that not all case studies employing multiple methods accord with the mixed methods definition used here that focuses on strategic combination of data sources and integration. However, the strategic use and integration of qualitative and quantitative data within case studies can enhance case study findings. Examples in existing literature of case studies that mix methods at the design and interpretation phases offer insights for the proposed study. A brief review of two such studies will follow a discussion of the use of mixed methods in studying the phenomenon of partnerships.

Mixed methods in partnership literature. It is notable that a review of partnership literature revealed only three studies that explicitly claimed to use mixed methods to investigate the partnership phenomenon (Hoff, 2002; Nowell & Foster Fishman, 2011; Scales et al., 2005). Hoff’s (2002) study of a Georgia partnership utilized a survey with one open-ended question. Minimal discussion of the qualitative data was included and therefore data integration contributed little to findings. Nowell and Foster Fishman (2011) used an approach in which qualitative data were utilized to develop a quantitative survey instrument to inform the creation of a framework for organizational capacity. Scales et al. (2005) combined survey data with interview and observational findings in a discussion in order to understand student outcomes associated with an educational partnership.

Besides these published research reports, FSG, a non-profit research and evaluation consulting firm, recently conducted a study of collective impact organizations utilizing both survey and interview data. Although a FSG staff researcher noted the benefits of the collecting
multiple datasets, citing richness and depth of understanding (A. Bhatt, personal communication, August 9, 2013), no study results are available to date. The lack of mixed method case studies in partnership literature is notable, indicating that a mixed methods case study may make a methodological contribution to this field of inquiry.

**Examples of mixed method case studies.** Hu and McGrath (2012) employed a mixed methods case study design to understand the role of information and communication technology (ICT) implementation and policies in one institution’s College English reform initiatives within its English as a Foreign Language program. An embedded mixed methods design was used in which questionnaire data were embedded within a case study with a primary intent of understanding the state of ICT implementation within a context of national educational reform. The secondary quantitative questionnaire was embedded within this larger design for the purposes of triangulation and complementarity, and these researchers integrated data by using qualitative data to illustrate and expand upon quantitative findings in their discussion. Hu and McGrath used interview excerpts to suggest explanations for and expand upon survey findings while maintaining focus on the study’s qualitative findings. The presentation of quantitative findings along with qualitative interview excerpts in the discussion section provided a model for correlating survey themes with interview data in the case study report. Similar data correlation techniques were used to integrate data in this study’s discussion.

Powell et al. (2013) described the research design for a planned mixed methods case study to understand the implementation experiences of community-based organizations providing youth mental health services. The authors proposed an embedded mixed methods design in which a survey would be developed and the survey data, as well as data from an existing standardized measure, are embedded within a multiple case study. The primary intent is
to understand implementation contexts and processes in children’s social service organizations while the secondary quantitative survey methods are embedded within this larger design for the purpose of triangulation. Powell et al. (2013)’s proposed use of joint displays to integrate data suggested methods of displaying quantitative survey findings with qualitative themes from interviews that were implemented within the data integration table in Chapter Four.

**Challenges in mixed methods case study designs.** Conducting a mixed methods case study presents challenges inherent to both the case study methodology mixed method research designs. In particular, the researcher must be able to effectively collect and analyze both qualitative and quantitative data as well as integrate those data, requiring expertise in various fields of inquiry. In this case, a background in qualitative research techniques and in mixed methods techniques is especially important. My course background in qualitative research methods and in mixed methods research was crucial during this process.

Validity and generalizability are also challenges associated with the case study design according to Merriam (2009). Because both qualitative and quantitative data are collected, relevant concerns for this study were instrument validity and reliability of qualitative findings. Merriam recommended enhancing reliability and validity of data via data triangulation, member checking, peer examination of data and processes, and creating an audit trail. Because of its contextual nature, case study data is not generalizable to a wide audience, however some findings may be transferrable to similarly situated cases. Validity issues will be discussed in more depth within the descriptions of qualitative and quantitative methods in this chapter.

Yin (2009) identified an additional challenge to mixed methods case studies when he pointed out that the original phenomenon under investigation could become the context rather than the focus of the study. A case study may place an undue focus on the secondary level
question and methods, failing “to return to the larger unit of analysis” (Yin, 2009, p. 52). This requires the researcher to maintain focus on the study’s purposes throughout data collection and analysis.

**Sampling Overview**

There were four distinct instances of sampling in this study. First and foremost, case identification is a crucial sampling phase in case study research. Within the case study, each qualitative strand utilized a separate set of participants while the quantitative strand drew upon a third sample. Purposive sampling, a non-probabilistic technique based upon researchers’ needs to select participants from whom most can be learned (Merriam, 2009), was used throughout the course of the study. After a discussion of case study sampling, specific sampling strategies for each data collection event will be included within the discussions of qualitative and quantitative methods. An overview of sampling and data sources is provided in Table 3.

**Case sampling.** As noted above, a single case study approach was utilized in this study drawing upon the unique case rationale (Yin, 2009). The ESCP is the only one of the six hubs within the SSCA to utilize an intermediary organization to lead its STEM education reform efforts. Likewise, the SSCA was modeled upon a statewide STEM change initiative in another state and here, as in the SSCA, leadership for regional divisions are housed within educational institutions either at the K-12 or post-secondary levels. Intermediary leadership via the RFE, a third-party institution that is not an education provider is, therefore, unique in the context of statewide STEM education reform efforts utilizing regional partnerships. The use of an intermediary organization to lead a change effort is a hallmark of Kania and Kramer’s (2011) collective impact and this case provided a novel opportunity to examine how such an organization enacts collective impact to create an infrastructure for change.
Table 3

*Data Sources and Data Collection Methods for a Mixed Methods Case Study of the ESCP*

<table>
<thead>
<tr>
<th>Research Questions</th>
<th>Data Collection Tool</th>
<th>Data Type</th>
<th>Sub-Category</th>
<th>Collection Methods</th>
<th>Analysis Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (What are the overall characteristics of the partnership?)</td>
<td>Archived Documents</td>
<td>Qualitative</td>
<td>Grant application documents/ Sustainability plan</td>
<td>Notes</td>
<td>Typological</td>
</tr>
<tr>
<td>1</td>
<td>Semi-Structured Interviews</td>
<td>Qualitative</td>
<td>Staff (Director) interviews (n=4)</td>
<td>Digital audio recording Notes Transcription</td>
<td>Typological</td>
</tr>
<tr>
<td>2 (How do partners perceive the partnership’s progress toward creating an infrastructure for change?)</td>
<td>Semi-Structured Interviews</td>
<td>Qualitative</td>
<td>Staff (Director) interviews (n=4)</td>
<td>Digital audio recording Notes Transcription</td>
<td>Typological</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>Partner interviews (n=8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 (What is the level of collaboration in the partnership?)</td>
<td>Survey</td>
<td>Quantitative</td>
<td>Wilder Collaboration Factors Inventory (n=50)</td>
<td>Qualtrics (online survey platform)</td>
<td>Descriptive statistics and instrument reliability statistics generated via Excel and SPSS</td>
</tr>
<tr>
<td>4 (How do measures of the level of collaboration enhance understanding of the partnership’s efforts to create an infrastructure for change?)</td>
<td>Findings from research questions 1-3</td>
<td>Qualitative</td>
<td></td>
<td></td>
<td>Data integration via table and discussion</td>
</tr>
</tbody>
</table>
Qualitative Strand

Qualitative data were used to answer the first two research questions: *What are the overall characteristics of the partnership?* and *How do partners perceive the partnership’s progress toward creating an infrastructure for change as defined by its progress in the five characteristics of collective impact organizations?* Separate samples and data sources were collected for the two questions, and therefore each will be considered separately in the following sections.

**What are the overall characteristics of the partnership?** Participants with close experience of the partnership’s structure, the ESCP Managing Director and the Learning Director, were recruited for interviews regarding the hub’s structure, goals, and short-term outcomes. Semi-structured interviews, characterized by open-ended, flexible questions (Rubin & Rubin, 2012) were be used to understand the partnership’s work and staff perspectives regarding progress in the five collective impact constructs. Two interviews were conducted with each of these individuals; the first to understand the overall characteristics of the partnership and the second to probe more deeply into staff perspectives regarding progress in collective impact. E-mail requests for participation were sent to these individuals (see Appendix A). An interview protocol is included in Appendix B. The protocol includes guiding questions and examples of probing questions that were used as follow-up queries. Participants chose the location of the interviews. The first interviews with each staff member were held in a conference room in the RFE offices in Eastville. The second set of interviews was conducted by phone. Each of the interviews lasted approximately one hour.

All interview data were audio recorded, using a Sony ICD-LX30 digital voice recorder, with the participants’ permission, and transcribed via a professional transcribing service. Each
set of interview data was checked for transcription accuracy by comparing a portion of the transcription with the audio recording. Additionally, I completely read each transcribed interview to check transcribing quality and to gain a sense of content before coding analysis began, and I recorded memos of initial thoughts regarding each interview in a separate document that was then attached to the corresponding set of data.

After preparation of the data as described above, the data were subject to typological analysis, a process by which the data set is divided into categories based upon common sense, theory, or research goals (Hatch, 2002). In this approach, the researcher divides data into a pre-determined set of typologies, and looks for patterns and themes within typologies, and utilizes data excerpts to support or challenge these themes (Hatch, 2002). Data were hand coded to allow for researcher immersion in the data and to facilitate the identification of patterns within typologies. The initial interview data were first coded for descriptive data, using the overall characteristics of the partnership as the typology, with structure, goals, and short-term outcomes as themes. These data were used to create a narrative description of the ESCP, supported by excerpts from interviews.

Data from staff member interviews was also coded using collective impact as a typology and the five characteristics of collective impact as themes. After marking data excerpts that correlated with each of the five themes associated with collective impact, I entered these data into a spreadsheet. I then re-read the data by themes in the spreadsheet, looking for patterns and relationships within these data. Such patterns and relationships were used to identify sub-themes, which were then marked on the spreadsheet as separate codes. Findings were included in the narrative description where appropriate and were also included in the data analysis for research question two.
Additionally, archived documents, including hub application documents submitted to the SSCA and the ESCP’s plan for sustainability were requested from ESCP staff as part of the interview. Documents were reviewed to contribute to the narrative description of the partnership. A typological analysis utilizing typologies and themes parallel to those described above was used.

**How do partners perceive the partnership’s progress toward creating an infrastructure for change as defined by its progress in the five characteristics of collective impact organizations?** Network sampling was used to identify typical case participants with sufficient knowledge of ESCP structure and activities to provide rich descriptions of the organization’s activities along the five characteristics of collective impact. Hub staff were the primary source of participant referrals, and were asked to provide names of four to six partners from each of the four stakeholder groups (K-12 education, post-secondary education, the business sector, and community groups) who have been actively involved in ESCP planning or execution of the hub’s work. In order to minimize staff bias in providing contacts, I fully discussed the goals of this study with staff members and ensured participant confidentiality. Staff members expressed enthusiasm for documentation of their work, and added that critical comments regarding the hub’s work would be productive and useful contributions to the study and to the hub’s work. Because the intent was to target individuals who both had an active involvement with the hub’s work and who would be willing to participate in interviews, however, it was not possible to completely mitigate bias in participant selection.

Hub staff provided a list comprised of six business partners, five postsecondary partners, eight K-12 partners, and six partners from community-based organizations. Two individuals were purposefully selected from each of the four stakeholder groups and recruited via e-mail (see
Appendix A) for interviews. Two participants per stakeholder group were interviewed in order to allow for an in-depth understanding of perspectives from typical case participants in each stakeholder group. These participants were chosen purposefully to provide a maximum variation (Hatch, 2002) range of perspectives within groups. For instance, within the business stakeholder group, a partner from a chamber of commerce and one from private industry were selected. Similarly, within the post-secondary education group, I chose a participant from a state university and one from a community college. This sampling strategy is used with the recognition that, even within stakeholder groups, partners represent a diversity of institutional cultures that may affect their perspectives regarding ESCP progress. Table 4 provides an overview of participant demographics and pseudonyms.

Table 4

<table>
<thead>
<tr>
<th>Partner Name (pseudonym)</th>
<th>Stakeholder Group</th>
<th>Organization/Position</th>
<th>Advisory Board Member</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mike Lewellen</td>
<td>Business</td>
<td>Chamber of Commerce, Vice President</td>
<td>Yes</td>
</tr>
<tr>
<td>Colin Taylor</td>
<td>Business</td>
<td>Insurance Company, Vice President</td>
<td>Yes</td>
</tr>
<tr>
<td>Roger Potts</td>
<td>K-12</td>
<td>High School Science Teacher</td>
<td>No</td>
</tr>
<tr>
<td>Nick Browning</td>
<td>K-12</td>
<td>High School Math Teacher</td>
<td>No</td>
</tr>
<tr>
<td>Charles Stafford</td>
<td>Post-secondary</td>
<td>Community College Dean</td>
<td>Yes</td>
</tr>
<tr>
<td>Laura Smithson</td>
<td>Post-secondary</td>
<td>4-year University, Director of School of Education</td>
<td>Yes</td>
</tr>
<tr>
<td>Victor Houseman</td>
<td>Community Group</td>
<td>Museum, Executive Director</td>
<td>Yes</td>
</tr>
<tr>
<td>David Marsh</td>
<td>Community Group</td>
<td>Aquarium/Zoo, Educator</td>
<td>No</td>
</tr>
</tbody>
</table>

Semi-structured interviews (Merriam, 2009) were conducted according to an interview protocol (see Appendix B) to understand progress toward collective impact. Each interview lasted approximately one hour and was held in the setting of the participant’s choice. Each of the
interviews was conducted on site in Eastville, with the exception of the interview with Colin Taylor, which was conducted via telephone. All interview data were digitally recorded using a Sony ICD-LX30 digital voice recorder with the participants’ permission and were transcribed via a professional transcribing service. Each set of interview data was checked for transcription accuracy by comparing a portion of the transcription with the audio recording. Additionally, I completely read each transcribed interview to check transcribing quality and to gain a sense of content before coding analysis began, and I kept memos of initial thoughts regarding each interview on a separate document that was attached to the corresponding set of data.

Typological analysis was used to interpret these data, using collective impact as the typology and the five characteristics of collective impact organizations as themes. After marking data excerpts that correlated with each of the five themes associated with collective impact, I entered these data into a spreadsheet. I then re-read the data by themes in the spreadsheet, looking for patterns and relationships within these data. Such patterns and relationships were used to identify sub-themes, which were then marked on the spreadsheet as separate codes. A code table summarizing these themes and sub-themes is provided in Table 5. A narrative analysis of each of the characteristics was created, using data excerpts as supporting evidence, highlighting different perspectives among partners and stakeholder groups.

**Qualitative validation.** Merriam (2009) summarized the difficulties in validating interview data by pointing out that validity in qualitative data “must be assessed in terms of something other than reality itself (which can never be grasped)” (p. 213). Instead, qualitative validity, according to Merriam, rests upon the credibility and trustworthiness of findings. She presented several validation techniques including triangulation of data sources and/or
investigators, member checking or respondent validation, peer or expert review, and an audit trail.

Member checks were conducted for both staff and partner interviews. Both staff members interviewed were e-mailed a copy of the narrative description of the ESCP derived from interviews and review of archival documents and asked to review the narrative for accuracy. One staff member responded and indicated her agreement with the narrative as written. Partner interview participants were contacted via e-mail for feedback at the end of the coding process as well. Participants were sent a summary of interview responses organized by theme. Three interview participant responded and all indicated that the summary captured their perspectives as expressed in the interviews.

In order to provide an additional measure of internal validity in coding, a peer debriefer (Creswell & Miller, 2000) with background in qualitative data analysis checked the coding. Creswell and Miller (2000) stipulated that the ideal peer debriefer is “someone external to the study” (p. 129) who provides a critical lens for data analysis. I provided my peer debriefer with a description of collective impact, the theoretical framework used in the typological coding, including excerpts from existing literature describing each of the five themes in detail. After a discussion of the five characteristics of collective impact indicated a shared understanding of the themes, the peer debriefer randomly selected one participant interview and independently coded the data for the five themes. Overall, agreement on the coding was very good. No significant differences in coding were identified although the peer debriefer noted that little evidence existed for one theme (shared measurement) in the interview she coded. After agreeing that my analysis yielded correspondingly little data for this theme, we concluded that her coding matched mine very closely.
Table 5

*Partner Interview Codes*

<table>
<thead>
<tr>
<th>Thematic Code</th>
<th>Sub-Theme</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Common Agenda</strong></td>
<td></td>
<td>The ability of the organization to formulate a <em>shared vision for change</em> via a <em>common understanding of the problem</em> and agreed upon approach and actions</td>
<td>“Our local businesses are struggling to fill good-paying jobs requiring strong skills in science, technology, engineering and math. Yet our students’ test scores show they are not prepared to take on these jobs.”</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>“I interpret the vision to be a community that embraces STEM education.”</td>
</tr>
<tr>
<td><strong>Common Agenda</strong></td>
<td><em>Incubate and Disseminate</em></td>
<td>The hub acts as an incubator for educational innovations that are then disseminated regionally.</td>
<td>“what we didn’t want was that this STEM concept was going to be just for these 300 students at this one school...but to make it region wide.”</td>
</tr>
<tr>
<td><strong>Common Agenda</strong></td>
<td><em>Connect</em></td>
<td>A key hub strategy in achieving its vision is to connect partners across stakeholder groups</td>
<td>“networking agency,” “bridging gaps”</td>
</tr>
<tr>
<td><strong>Shared measurement</strong></td>
<td></td>
<td>Consistent data collection and measurement of results</td>
<td>“we don’t have what I feel is a really solid measurement system in place”</td>
</tr>
<tr>
<td><strong>Shared measurement</strong></td>
<td><em>Uncertainty</em></td>
<td>Partners unsure about data collection and measurement</td>
<td>“I’m not sure how they measure”</td>
</tr>
<tr>
<td><strong>Shared measurement</strong></td>
<td><em>Role of qualitative versus quantitative data</em></td>
<td>How and whether to use school-level data as opposed to tracking less measurable constructs such as attitudes and relationship patterns.</td>
<td>“I’m very opposed to using student test scores” “real outcomes on real individuals”</td>
</tr>
<tr>
<td><strong>Shared measurement</strong></td>
<td><em>Long-term focus</em></td>
<td>The need for longitudinal data to assess outcomes</td>
<td>“We take a long view in this”</td>
</tr>
</tbody>
</table>
### Partner Interview Codes

<table>
<thead>
<tr>
<th>Thematic Code</th>
<th>Sub-Theme</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutually Reinforcing Activities</td>
<td></td>
<td>Leveraging competencies of partners to create a complementary set of activities coordinated by a backbone organization</td>
<td>“[partner roles] are about what they need and what you need to be able to be responsive.”</td>
</tr>
</tbody>
</table>
| Mutually Reinforcing Activities | Hub as coordinator            | Hub staff connecting stakeholders and defining roles                                                                                                                                                                                                                                                                                                                                                                                                                      | “They make connections and put people together”  
“This partnership is sort of a – almost like an organic being”                                                                                                                                                                                                                                                                               |
| Mutually Reinforcing Activities | Partner roles                 | Differentiation of roles among stakeholder groups                                                                                                                                                                                                                                                                                                                                                                                                                      | “to support teachers and figure out how our resources can be used within schools”  
(community group/non-profit)  
“the business partners are giving students and faculty a taste of what it’s like in advanced manufacturing”                                                                                                                                                                                                                                         |
| Mutually Reinforcing Activities | Strategic use of resources     | Using partner capabilities efficiently                                                                                                                                                                                                                                                                                                                                                                                                                                   | “don’t go ask a logistics company to paint your building. Why don’t you ask a logistics company to take a look at your bus routes?”                                                                                                                                                                                                                       |
| Mutually Reinforcing Activities | Mutual learning and cooperation | Partners sharing learning across sectors and cooperating in hub activities.                                                                                                                                                                                                                                                                                                                                                                                             | “[this is] a very rich way to share experiences.”  
“nobody sees it as someone else’s job”                                                                                                                                                                                                                                                                                                    |
| Continuous Communication       | Consistent and open communication in an atmosphere of trust |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | “a kind of personal reaching out.”                                                                                                                                                                                                                                                                                                     |
### Partner Interview Codes

<table>
<thead>
<tr>
<th>Thematic Code</th>
<th>Sub-Theme</th>
<th>Definition</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous</td>
<td>Communication strategy</td>
<td>Staff member communication with stakeholder groups and creating an atmosphere of open communication.</td>
<td>“electronic rolodex with everyone’s contact information”</td>
</tr>
<tr>
<td>Continuous</td>
<td>Relationships across institutional cultures</td>
<td>Relationships and communication between partners from different stakeholder groups.</td>
<td>“If you’ve been in the classroom for 25 years, it can be a little intimidating to contact businesspeople”</td>
</tr>
<tr>
<td>Backbone Support</td>
<td>Hub as connector</td>
<td>The backbone organization acting as a network agency</td>
<td>“they’ve done a really good job in establishing some strong relationships”</td>
</tr>
<tr>
<td>Backbone Support</td>
<td>RFE role</td>
<td>The value of intermediary leadership</td>
<td>“neutral ground”</td>
</tr>
<tr>
<td>Backbone Support</td>
<td>Individual personalities and backgrounds</td>
<td>Value of individuals holding staff positions</td>
<td>“the structure is a good structure, but people are just as important”</td>
</tr>
<tr>
<td>Backbone Support</td>
<td>Sustainability</td>
<td>Concerns regarding sustainability, particularly finding funding sources to maintain the backbone organization. Also the possibility that the organizational leadership may no longer be necessary at some point.</td>
<td>“part of their strategy has been to – from the very beginning – make those contacts with agencies and organizations that can assist them...to make it sustainable”</td>
</tr>
</tbody>
</table>
Additionally, expert review is inherent in the dissertation research process, and committee review of methodology, data collection, and data analysis techniques contributed to the validity of findings. Finally, Merriam (2009) encouraged researchers to maintain an audit trail to describe data collection, decision points, and interaction with data. This audit trail has its foundation in the description of methods within this chapter (Merriam, 2009) and was enhanced by keeping memos throughout the research process. These memos were kept via an electronic research journal and used to track decision points and observations throughout the research process.

Similarly, Yin (2009) promoted three principles of data collection that enhance validity and reliability of case study data. Like Merriam (2009), Yin advocated for the use of multiple sources of evidence and, in particular the “development of converging lines of inquiry” (p. 115). This data and methodological triangulation was achieved by the collection of both interview and survey data and the use of side-by-side analyses of the data highlighting points of convergence and divergence. Yin also recommended creating a case study database and maintaining a “chain of evidence” (Yin, 2009, p. 122) composed of researcher notes, case study documents, quantitative data results, and narratives. The dissertation research process effectively facilitated the maintenance of a database, and all relevant documents were stored in a dedicated PC file folder for ease of retrieval and integration.

**Quantitative Strand**

Quantitative data in the form of survey results were collected to answer the third research question, *What is the level of collaboration in the partnership?* The Wilder Collaboration Factors Inventory, an instrument developed by the Wilder Research Center based upon Mattesich et al.’s (2001) collaboration factors, was administered to partners to measure collaboration within
the partnership. This instrument, designed to be used by partners in cross-sector partnerships, measures 20 collaboration factors and was used because of its sound basis in collaboration literature and evidence supporting its validity. The following sections will discuss the Wilder Collaboration Factors Inventory, data analysis techniques, and quantitative validity issues.

Wilder Collaboration Factors Inventory. While the Wilder Collaboration Factors Inventory was initially developed as a practical tool for partnerships wishing to launch discussions of collaboration, its widespread use in a variety of CSSPs led to further research efforts to support its validity. In particular, a study using the instrument to measure collaboration between community colleges and job centers revealed Cronbach’s alpha scores between .66 and .86 for 14 of the 20 collaboration factors (Townsend & Shelley, 2008). Researchers noted that although reliability measures were lower for three factors (cross-section of members, unique purpose, and sufficient resources), “a closer examination of the data revealed important relationships between the items revealing these factors” (Townsend & Shelley, 2008, p. 108). The three remaining factors contained only one item and could therefore not be analyzed by exploratory factor analysis. Overall findings indicated that “for established collaborative efforts, the Wilder instrument can be used as an evaluation tool to assess the level of collaboration” (Townsend & Shelley, 2008, p. 111), a finding that justifies its use for this study.

The Wilder Collaboration Factors Inventory consists of 40 items representing 20 collaboration factors, which Mattesich et al. (2000) grouped into six broad categories, environment, membership characteristics, process and structure, communication, purpose, and resources. Each of the 20 collaboration factors is comprised of one to three survey items.
Mattesich et al. (2000) offered a scoring system to rank level of collaboration (LOC) for each of the twenty factors into three categories, strong, borderline, and concern, based upon respondents’ mean scores for collaboration factors. The survey creators recommended calculating factor as simple mean scores, combining component questions into one group and using as n the number of combined responses for the component items. Townsend and Shelley (2008) refined Mattesich et al.’s (2000) recommended scoring system by separating the original borderline category into two separate categories based upon empirical findings that a more nuanced understanding of the category would help to understand survey findings. Townsend and Shelley (2008) recommend the following scoring system for LOC: strong (≥ 4.0); approaching strength (3.5 – 3.9); approaching concern (3.0 – 3.4) and concern (≤ 2.9). Where a score fell between two categories (for example, 3.45) in this study, it was rounded up to the higher LOC.

Rather than using Mattesich et al.’s six broad categories in this study, the twenty factors were regrouped to relate to the five characteristics of collective impact organizations for the purpose of this study (see Figure 3, Chapter One). Because Mattesich et al.’s LOC scoring system is based upon individual factors, with categories used only as loose groupings of factors to facilitate partnership conversations around results, this regrouping does not affect the validity of the LOC scores. Indeed, the survey creators acknowledge that “there is no research significance to the category groupings” (Mattesich et al., 2001, p. 67) Additional validity procedures for the regrouping of factors are discussed in Chapter Four.

**Survey sampling and administration.** Survey sampling techniques require that the researcher first define the ideal population to achieve the survey’s goals, a population that Kalton (1983) calls the target population and Fowler (2009) labels the sampling frame. In this case, the ideal population was all ESCP partners. Staff members were asked to provide a comprehensive
list of partner organizations and e-mail addresses for primary contacts within those organizations. This included the Advisory Board listing along with a supplemental list of actively involved partners who do not serve on the advisory board since the instrument is intended to measure phenomena experienced uniquely by individuals with first-hand involvement in the partnership. Multiple individuals within an organization were included where hub staff indicated that participation in the partnership is shared and that the individuals have participated meaningfully in partnership activities.

The Wilder Collaboration Factors Inventory was administered to 50 ESCP partners identified by hub staff as individuals who have been active in the partnership to the extent that they can assess collaboration. This group was comprised of the 32 members of the hub Advisory Board and 18 active partners from each of the four stakeholder groups. The final sample represented 15 stakeholders from K-12 education, 11 from post-secondary education, 12 from the business sector, and 12 from community-based/non-profit organizations for a total sample of n=50.

Participants were e-mailed an introductory and explanatory message (see Appendix A) with a link to an on-line survey administered via Qualtrics. The survey (see Appendix C) included an introduction to the research project, assuring participant confidentiality and the voluntary nature of participation.

The fifty participants were asked to rate their level of agreement with 40 statements on a five-point Likert scale after completing a brief background information section asking them to indicate what stakeholder group they represent and how they perceive their level of involvement in the ESCP. The survey was administered via Qualtrics, a web-based survey tool. A Likert scale of one to five was used, in which one indicates Strongly Disagree and five indicates
**Strongly Agree.** Paul Mattesich, survey creator and Executive Director of Wilder Research, granted permission for the instrument to be used in this study (personal communication, September 18, 2013).

The survey was administered via an e-mail link sent on February 19, 2014. Reminders were e-mailed to stakeholders on March 4 and March 14, 2014, and the survey was closed on March 19, 2014. A total of 32 responses were received through Qualtrics. Of these 32 responses, five had no responses to any questions and were therefore eliminated, leaving 27 responses for a response rate of 54%. The response rate within stakeholder groups varied widely, however. Table 6 summarizes response rates within groups and for the entire sample. Besides the fact that the small sample sizes and wide variation in stakeholder group response rates prohibited the use of inferential statistics to compare groups, the lack of responses from business group stakeholders may have implications for collaboration that will be discussed further in Chapter Five.

Table 6.

*Response Rates for Wilder Collaboration Factors Inventory.*

<table>
<thead>
<tr>
<th>Stakeholder Group</th>
<th>Sample Size</th>
<th>Number of Responses</th>
<th>Response Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>K-12</td>
<td>15</td>
<td>11</td>
<td>73%</td>
</tr>
<tr>
<td>Post-secondary</td>
<td>11</td>
<td>6</td>
<td>54%</td>
</tr>
<tr>
<td>Business</td>
<td>12</td>
<td>1</td>
<td>8.3%</td>
</tr>
<tr>
<td>Community group/nonprofit</td>
<td>12</td>
<td>9</td>
<td>75%</td>
</tr>
<tr>
<td><strong>All groups</strong></td>
<td><strong>50</strong></td>
<td><strong>27</strong></td>
<td><strong>54%</strong></td>
</tr>
</tbody>
</table>

Twenty five respondents indicated that their organizations are current partners in the ESCP while two respondents, both representing community groups/non-profit organizations,
indicated that they were not sure of their organization’s partnership status. In spite of this uncertainty, however, one indicated active involvement in the hub’s activities and the other indicated that they were somewhat involved in the hub. A total of fourteen participants indicated that they are actively involved in hub activities, defined as participating at least once a month in meetings or ESCP activities. Twelve responded that they are somewhat involved, participating in meetings or activities at least quarterly. One participant from the community group/non-profit organization stakeholder group responded that they have little involvement in hub activities, rarely participating in meetings or activities, although this person responded that his or her organization is a partner in the ESCP.

Of the 27 responses, three were incomplete, with one K-12 respondent missing responses to 7 items, one community group/non-profit respondent missing responses to 20 items, and one community group/non-profit respondent missing responses to 26 items out of 40. I made the decision to include these incomplete responses since, in cases where item nonresponse is less than 5%, there is a minimal likelihood that the nonresponse will distort statistical estimates (Fowler, 2009). The SPSS software used to analyze the data uses the number of non-missing variable responses for each item, adjusting the n value for each response.

**Quantitative data analysis.** Survey data were exported from Qualtrics to an Excel spreadsheet and SPSS. SPSS software was utilized for data analysis because of the wide range of data analysis options and features that facilitate data management. The exported database was checked by calculating range of responses and randomly selecting five sets of responses to check against the original data. Data were analyzed for descriptive statistics overall and according to individual items and collaboration factors. Mean scores and standard deviations were calculated for the entire sample and by stakeholder group.
While I had hoped to provide comparative statistics to highlight significant differences between stakeholder groups, small and widely divergent response rates across groups meant that the assumption of homogeneity of variance necessary for ANOVA was not met. The Kruskal-Wallis test, a non-parametric statistical technique used to compare more than two independent samples (Vargha & Delaney, 1998) was also considered to compare stakeholder group responses. This technique utilizes a null hypothesis of stochastic homogeneity and compares individual rankings between groups (Ruxton & Beauchamp, 2008). The Kruskal-Wallis techniques were determined not to be appropriate in this case because the grouping of items into factors and then the grouping of factors into collective impact themes would require comparison of means rather than the individual response rankings necessitated by non-parametric techniques. After carefully considering the requirements of parametric and non-parametric statistical tests and conferring with two professionals in the field of statistics (Jack Dagg, personal communication March 21, 2014; Dr. Toni Sondergeld, personal communication, March 22, 2014) I concluded that I should limit my analysis of results to descriptive statistics.

Statistical results are represented via text discussion and tables displaying descriptive statistics overall and for stakeholder groups. Results were used to identify the overall level of collaboration within the partnership as strong, approaching strength, approaching concern, and concern. This scale was used within each of the categories of collaboration factors and to represent findings for each individual stakeholder group.

Cronbach’s alpha tests were performed within each of the collaboration factors composed of more than one item in order to provide further evidence for the internal validity of the instrument in this context. Since the factors were regrouped to correlate with the five characteristics of collective impact organizations, Cronbach’s alpha tests were performed on
these re-grouped collaboration factors (see Table 7) in order to provide insight into the usefulness of the Wilder Collaboration Factors survey in evaluating collective impact organizations.
Table 7.

Relationship Between Survey Items, Collaboration Factors, and Collective Impact Themes.

<table>
<thead>
<tr>
<th>Collective Impact (C.I.) Theme</th>
<th>Related Collaboration Factor</th>
<th>Survey Items (Note: the term “our collaboration/ive” or “this collaborative group” is substituted for identifying information)</th>
</tr>
</thead>
</table>
| Common Agenda                 | History of collaboration in the community | 1. Agencies in our community have a history of working together.  
2. Trying to solve problems through collaboration has been common in this community.  
It’s been done a lot before. |
| Common Agenda                 | Favorable political and social climate | 5. The political and social climate seems to be “right” for starting a collaborative project like this one.  
6. The time is right for this collaborative project. |
| Common Agenda                 | Appropriate cross-section of members | 9. The people involved in our collaboration represent a cross section of those who have a stake in what we are trying to accomplish.  
10. All the organizations that we need to be members of this collaborative group have become members of the group. |
| Common Agenda                 | Concrete, attainable goals and objectives | 31. I have a clear understanding of what our collaboration is trying to accomplish.  
32. People in our collaborative group know and understand our goals.  
33. People in our collaborative group have established reasonable goals. |
| Common Agenda                 | Shared vision                  | 34. The people in this collaborative group are dedicated to the idea that we can make this project work.  
35. My ideas about what we want to accomplish with this collaboration seem to be the same as the ideas of others. |
| Common Agenda                 | Unique purpose                 | 36. What we are trying to accomplish with our collaborative project would be difficult for any single organization to accomplish by itself.  
37. No other organization in the community is trying to do exactly what we are trying to do. |

(continued)
<table>
<thead>
<tr>
<th>Collective Impact (C.I.) Theme</th>
<th>Related Collaboration Factor</th>
<th>Survey Items (Note: the term “our collaboration/ive” or “this collaborative group” is substituted for identifying information)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Measurement</td>
<td>Appropriate pace of development</td>
<td>24. This collaborative group has tried to take on the right amount of work at the right pace. 25. We are currently able to keep up with the work necessary to coordinate all the people, organizations, and activities related to this collaborative project.</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Members see collaboration as in self-interest</td>
<td>11. My organization will benefit from being involved in this collaboration.</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Ability to compromise</td>
<td>12. People involved in our collaboration are willing to compromise on important aspects of our project</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Members share stake in process and outcome</td>
<td>13. The organizations that belong to our collaborative group invest the right amount of time in our collaborative efforts. 14. Everyone who is a member of our collaborative group wants this project to succeed. 15. The level of commitment among the collaboration participants is high.</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Multiple layers of participation</td>
<td>16. When the collaborative group makes major decisions, there is always enough time for members to take information back to their organizations to confer with colleagues about what the decision should be. 17. Each of the people who participate in decisions in this collaborative group can speak for the entire organization they represent, not just a part.</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Flexibility</td>
<td>18. There is a lot of flexibility when decisions are made; people are open to discussing different options. 19. People in this collaborative group are open to different approaches to how we can do our work. They are willing to consider different ways of working.</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Development of clear policy roles and guidelines</td>
<td>20. People in this collaborative group have a clear sense of their roles and responsibilities. 21. There is a clear process for making decisions among the partners in this collaboration.</td>
</tr>
<tr>
<td>Collective Impact (C.I.) Theme</td>
<td>Related Collaboration Factor</td>
<td>Survey Items</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>------------------------------</td>
<td>--------------</td>
</tr>
</tbody>
</table>
| Continuous Communication      | Mutual respect               | 7. People involved in our collaboration always trust one another.  
|                               |                              | 8. I have a lot of respect for the other people involved in this collaboration.  
|                               | Open and frequent            | 26. People in this collaboration communicate openly with one another.  
|                               | communication                | 27. I am informed as often as I should be about what goes on in the collaboration.  
|                               |                              | 28. The people who lead this collaborative group communicate well with the members.  
|                               | Established informal         | 29. Communication among the people in this collaborative group happens both at formal meetings and in informal ways.  
|                               | relationships and            | 30. I personally have informal conversations about the project with others who are involved in this collaborative group.  
|                               | communication links          |              |
| Backbone Support              | Collaborative group          | 3. Leaders in this community who are not part of our collaborative group seem hopeful about what we can accomplish.  
|                               | seen as legitimate leader    | 4. Others (in this community) who are not part of this collaboration would generally agree that the organizations involved in this collaborative project are the “right” organizations to make this work.  
|                               |                              |              |
| Backbone Support              | Adaptability                 | 22. This collaboration is able to adapt to changing conditions, such as fewer funds than expected, changing political climate, or change in leadership.  
|                               |                              | 23. This group has the ability to survive even if it had to make major changes in its plans or add some new members in order to reach its goals.  
|                               |                              |              |
| Backbone Support              | Sufficient funds, staff,     | 38. Our collaborative group has adequate funds to do what it wants to accomplish.  
|                               | materials, and time          | 39. Our collaborative group has adequate “people power” to do what it wants to accomplish.  
|                               |                              |              |
| Backbone Support              | Skilled leadership           | 40. The people in leadership positions for this collaboration have good skills for working with other people and organizations.  |
Quantitative validation. The small sample size (50 participants) for the survey presented threats to the validity of inferential statistics in this study and ultimately the small and uneven sample sizes meant that inferential techniques such as ANOVA would be inappropriate. Although the intent was to survey the entire population of partners, Fowler (2009) pointed out that sampling error is a function primarily of sample size rather than proportion of the population sampled. The survey in this study, however, was intended to reflect perspectives of this particular partnership and was not intended to be generalizable to a larger population, thereby somewhat mitigating the influence of the small sample size. Descriptive statistics for the entire sample and for stakeholder groups were the primary output of the survey.

Besides sample size, Fowler (2009) pointed out two potential types of error in survey data collection. The first, sampling error, involves bias in data collection, either from excluding eligible individuals from the sample frame, failure to achieve a random sample, and participant failure to respond. The second type of error Fowler notes is error associated with answers, or the extent to which answers fail to represent truth.

Sampling error in this study was addressed by using a complete collection (Teddlie & Yu, 2007) sample of ESCP partners. To reduce the possibility that individual contacts in the ESCP’s database are not those most closely connected to the hub’s work, I discussed this concern with the ESCP’s Managing Director and Director of Learning to ensure the list’s accuracy before administering the survey. Staff members assured me that the list is the most current available and, to their knowledge, accurately reflects participation. Participant failure to respond is a concern, especially with a relatively small sample. In order to encourage participants to respond, several survey administration strategies were employed. These strategies include using inviting and engaging language in the e-mail invitation (see Appendix A), making
clear the purpose of the survey, providing clear instructions and information on the survey length, and issuing an e-mail reminder two weeks and four weeks after initial survey distribution.

Answer error is attributable to a number of factors including participants misunderstanding questions, lacking information to answer, and giving biased responses (Fowler, 2009). This type of error may also be due to lack of construct validity, or the ability of the items to measure the contrast they are intended to measure. Answer error was addressed by targeting the survey to individuals most likely to have an understanding of collaboration in the partnership (past and current ESCP partners) and by administering an easily understandable instrument firmly grounded in evidence. The Wilder Collaboration Factors Inventory has been used by the Rand Corporation in a study of a community health initiative (Pitkin Derose, Beatty, & Jackson, 2004) and in a study of a workforce development collaboration between community colleges and job centers (Townsend & Shelley, 2008). The latter study reported that factor analysis supported the constructs in the instrument as factors of successful collaboration. In this study, Cronbach’s alpha tests were conducted for each of the collaboration factors containing more than one survey item and for collaboration factors grouped into collective impact themes in order to provide evidence for construct validity in this context.

Mixed Methods Data Analysis

The two strands of data were collected and analyzed independently of one another and then merged in a final data analysis stage. Table 7 represents the relationships between items from the Wilder Collaboration Factor Index and the five collective impact themes. These relationships formed the basis for the data integration.

Data integration. Creswell and Plano Clark (2011) contended that two concepts, point of interface and mixing strategies, are useful for conceptualizing the process of mixing
quantitative and qualitative data strands in research studies. Four points of interface of data are possible over the lifespan of a study: design, data collection, data analysis, and interpretation (Creswell & Plano Clark, 2011). This study design employed mixing strategies at the design and interpretation phase.

At the design stage, a quantitative instrument was embedded within an overall qualitative case study approach. Since the data collection occurred in parallel, each strand of the study was designed independently and data were collected and analyzed independently.

Data integration accorded with techniques commonly used in concurrent mixed methods studies (Creswell & Plano Clark, 2011). Data from interviews with partnership staff were used to create a narrative description of the partnership, and interviews with a sample of partners were used to explore the partnership’s progress toward creating an infrastructure that supports long-term change. Concurrently, the Wilder Collaboration Factors Inventory was administered, and descriptive statistics representing participant responses to Likert-scale questions were generated. Synthesis of results occurred in a second phase, when data merging strategies, including displaying survey and interview findings in a side-by-side display (Plano Clark et al., 2010) were employed. Furthermore, findings were merged in a discussion to ultimately create a case study report that provides a holistic understanding of the organization’s progress in creating an infrastructure for change.

Interview findings for collective impact themes were merged with survey results via a side-by-side analysis in a summary table (Creswell & Plano Clark, 2011), presenting qualitative data concerning collective impact progress beside summaries of survey data for factors that scored in the strong (LOC ≥ 4.0) or concern (LOC ≤ 2.9) categories in order to highlight areas
of particular strength or weakness regarding collaboration. A column was included in the table to interpret findings and highlight divergences in LOC ratings between stakeholder groups.

**Mixed methods validation.** Onwuegbuzie and Johnson (2006) emphasized the complexity of mixed methods legitimation, a term they deemed a suitable alternative to the paradigmatically contentious word *validity*. In particular, they stressed that legitimation is an iterative process that must continue throughout the course of a study and that must both involve and supersede validity measures for individual research strands. In this case, the terms *validity* and *legitimation* are used interchangeably.

Indeed, case study designs present challenges to reliability and validity as noted earlier, and Creswell and Plano Clark (2011) pointed out that the use of mixed methods requires additional considerations. Methods for ensuring validity or legitimation in a mixed methods study should consider not only qualitative and quantitative data strands but also methods of combining these two types of data.

Onwuegbuzie and Johnson (2006) contended that legitimation is a process comprised of multiple checkpoints at which the researcher ensures that each phase of the study undergirds the quality of the concluding inferences. Creswell and Plano Clark (2011) similarly defined mixed methods validity as “employing strategies that address potential issues in data collection, data analysis, and the interpretations that might compromise the merging or connecting of the quantitative and qualitative strands of the study and the conclusions drawn from the combination” (p. 239). They described a number of potential validity threats in merging data including those involved with data collection, analysis, and interpretation. This parallels Onwuegbuzie and Johnson’s identification of multiple validities as a type of legitimation for
mixed methods studies in which addressing legitimation of the individual strands as well as data mixing strategies affects the quality of meta-inferences.

Threats to merged data validity were addressed in several ways. First, individuals from the same population (ESCP partners) were used for both qualitative and quantitative strands of the study. Although unequal sample sizes were utilized in the strands, interview participants were drawn from various stakeholder groups to ensure a cross-section of perspectives. Divergent findings in the two strands were addressed by reanalyzing data, and it was determined that such divergent findings suggested a need for future research and potential weaknesses in the survey instrument. Likewise, indications of divergent perspectives among stakeholder groups suggested areas for potential future research.

Creswell and Plano Clark (2011) specifically cited as a validity concern collecting different types of data that do not address the same topics and suggest that researchers address parallel questions in both types of data collection. While the qualitative and quantitative data in this study address different questions, a situation typical of embedded designs, there is a relationship between collective impact characteristics and the collaboration factors measured by the survey (see Table 7). These two data sources provided complementary perspectives on the partnership and therefore, used together, enhanced the understanding of the partnership’s structure and work.

**Inferences**

Inferences, according to Creswell and Plano Clark (2011) “are conclusions or interpretations drawn from the separate quantitative and qualitative strands of a study as well as across the quantitative and qualitative strands, called ‘meta-inferences’” (p. 213). A key consideration in any mixed methods study, regardless of the design, is adherence to the study’s
purpose and research questions, and therefore data analysis and data merging decisions were made within that context, and inferences ultimately reflected the study’s purpose to understand how the ESCP has created an infrastructure for change in STEM education.

Meta-inferences were drawn from the integrated data regarding the partnership’s characteristics and its progress toward creating an infrastructure for change. By combining qualitative findings regarding partnership characteristics and partner perspectives on progress toward collective impact with quantitative measures of collaboration within the partnership, a holistic picture of the partnership, its progress, and collaborative relationships emerged. These findings comprise a case study report that provides an understanding of how the characteristics of the partnership impact progress toward creating an infrastructure for change. These findings may have implications for organizations wishing to use intermediary-led partnerships to achieve their goals. The combination of a quantitative measure of collaboration with qualitative interview data also provides support for the use of mixed methods designs in studying cross-sector partnerships and lends insight into the use of the Wilder Collaboration Factors Inventory to investigate collective impact organizations.

**Ethical Issues**

Issues of research purpose disclosure, privacy, researcher bias, and participant risk were addressed via the Institutional Review Board (IRB) application process. The research purpose was fully disclosed to all participants via an attachment to e-mail communications (Appendix D) and in the survey introduction (Appendix C). Privacy issues were also addressed throughout the study, and all interview recordings and transcriptions are kept in a locked filing cabinet or on a password protected PC. Data will be destroyed two years after completion and defense of my dissertation; electronic data will be deleted and paper documents shredded.
All interview participants were assigned pseudonyms and details specific to their
organizations were omitted or altered to protect their identities. Although all reasonable efforts,
including assigning pseudonyms and changing details regarding demographics and geography,
were taken, it is important to note that the uniqueness of the case study site creates difficulty in
completely masking its identity to all potential readers, especially those who are experts in the
field of STEM education partnerships. The case description, however, was crafted with this
difficulty in mind and remains as neutral to location as possible while creating a narrative that is
sensitive to the unique features of this partnership. Partnership staff indicated an eagerness to
learn from this study, and staff members were aware that areas of improvement in its work may
be identified. Comments about partnership staff that are substantive and meaningful to
partnership work were included where relevant to the research questions. Survey participants
maintained anonymity and were not asked for personally identifying information. Although it
was not possible to prevent participants from communicating with one another regarding the
study, participants were assured that I would not disclose identities and would take measures to
protect identities. The risk to participants was considered minimal for this study.

Conclusion.

The mixed method case study approach provided an opportunity to create a rich
description of the ESCP’s work in creating a regional infrastructure for change in STEM
education. A holistic description of the case is provided in Chapter Four, including a narrative
description of the ESCP along with findings related to each research question. This discussion
includes a review of qualitative themes and survey findings, and an interpretation of implications
from these data. Inferences are drawn from interview and survey findings, and from areas of
convergence and divergence among stakeholder groups. An interpretation of lessons learned and implications for the ESCP and similarly structured partnerships is provided in Chapter Five.
Chapter Four: Findings

The story of the Eastern STEM Change Partnership (ESCP) emerged as a tale of making connections across institutional boundaries. The ESCP’s history tells of the marriage between organizational structure and individual capabilities. As the story unfolded during the course of this study, it became clear that the ESCP was forged with attention to flexibility, creativity, and the ability to use resources strategically. Most of all, however, this study revealed a story of community, and how one mid-sized southern city mobilized resources to impact the region’s economic future. One stakeholder used the elegant metaphor of a Polymerase Chain Reaction, a cascading chain reaction used to duplicate DNA in ever-increasing numbers, to capture the complexity and broad impact of the hub. The image of STEM initiatives being magnified and disseminated in an increasingly large area is a compelling one, and one that captures the essence of the hub’s goals.

The following sections will tell the ESCP’s story through qualitative data collected regarding the hub’s progress in collective impact and a quantitative measure of collaboration. This chapter will address the four research questions: 1) What are the overall characteristics of the partnership? 2) How do partners perceive the partnership’s progress toward creating an infrastructure for change as defined by its progress in the five characteristics of collective impact organizations? 3) What is the level of collaboration in the partnership? 4) How do measures of the level of collaboration enhance understanding of the partnership’s efforts to create an infrastructure for change?

Research Question 1

The first research question asks, What are the overall characteristics of partnership? The characteristics of the ESCP hub are complex and rooted in context, and an understanding of
this community’s culture and history is essential to understanding the partnership’s attributes. Indeed, the story of the ESCP began many years before the acronym STEM entered public consciousness. The following sections will outline the context for the ESCP, the origins of the hub, its structure, its goals, and the outcomes from its initial two years of work.

**Context.** The story is set in Eastville, the third largest city in this southern state. Eastville is located in Smith County and is nestled between picturesque mountains and a winding river that bisects the city. Its population of 170,000 is employed largely in its robust manufacturing and service industry sectors and its unemployment rates fall slightly under the national average. The city and surrounding counties are home to a variety of manufacturing facilities, including a high-tech plastics manufacturer and, most recently, a European automobile manufacturing plant. A major Internet retailer and a large insurance provider also call Eastville home, and there is a thriving tourist industry based upon outdoor activities including bicycling, kayaking, and mountain climbing. The city is home to a two-year post-secondary institution, Eastville State Community College (ESCC), a public four-year university, Southern University at Eastville (SUE), and two small, private four-year colleges.

The K-12 education system reflects the state’s educational history and the socio-economic diversity of the area. The state has traditionally placed near the bottom in national rankings of student performance, however concerted educational improvement efforts moved its ranking to the top half of states nationwide by 2012. A nationally recognized elite boarding school is located in the mountains outside the city, and one school district in the region is supported by an affluent private foundation that provides hundreds of thousands of dollars in support to its three schools whose students consistently score above average on standardized tests. At the other end of the spectrum, Smith County is home to five of the worst performing
schools in the state. Located in some of the poorest areas of the county, these schools, two elementary, two middle, and one high school, have shown no improvement in student performance over the last two years.

**Hub Origins.** To understand the origins of the ESCP, we must return to the year 1972 when a national news anchor announced to the American public that Eastville was the most polluted city in America. Decades of manufacturing run-off had left the East River an ecological wasteland, and it was reported that, in some areas, visibility was limited to less than 50 feet on a clear day due to emissions from industries and railroads. This negative publicity, coupled with deteriorating mountain views and increasing reports of pollution-related illnesses, was a call to action for Eastville. Industry and environmental groups came together in then-unprecedented alliances to clean up the city, and a groundbreaking pollution control ordinance was passed by the city in this same year. Concerted community action and industry – non-profit collaboration led to historic results: By 1975 every major pollution source in Smith County was in compliance with the new, strict standards. Today, Eastville’s air is clear, the river’s bio systems are returning, and the occurrence of pollution-related illnesses has plummeted.

The city’s recovery from the brink of environmental disaster is attributed to cross-sector collaboration, and gave rise to what is known as the “Eastville Way,” a tradition of public-private partnerships and collaboration for community improvement. Such partnerships are credited with the nationally recognized downtown revitalization of the past decade and the Eastville Way has indeed become a way of life for this city. The Regional Foundation for Education (RFE) is one of the organizations that reflect the collaborative spirit around community improvement in Eastville. This independent, non-profit, community-based organization has a 25-year history of providing training, research, and educational resources in
Smith County and the surrounding areas. The RFE’s mission is to improve student outcomes by encouraging effective teaching practices, strong school leadership, and strategic partnerships. The RFE is funded by a variety of private contributors and foundations and has an endowment of $10 million. Contributors include a wide array of community groups, local businesses, and charitable foundations.

It is on this foundation of community collaboration that the ESCP was built. In 2010, the state was awarded federal Race to the Top (RTTT) funds for public school improvement. Approximately $16 million of the $500 million award was earmarked for the formation of the State STEM Change Association (SSCA). The SSCA identified its strategy as a collaborative one based upon a network of regional hubs. A request for proposals was released for the formation of six regional hubs across the state, and it was this that caught the attention of Eastville community leaders. The RFE spearheaded the effort to submit a proposal to the state for a regional STEM hub and a STEM high school.

**Hub Initiation and Structure.** The grant proposal-writing process was an apt illustration of the “Eastville Way,” and the final grant application to the state noted that over 200 members of the community participated in a series of community discussions about STEM education. The ESCP’s Managing Director Karen Banks said of the grant writing process,

> it got a huge amount of grassroots support – probably because I think the way we went about it…It was a community process. We had what we called community discussion sessions on STEM… I even had sixth grade boys at one because they had a basketball game and it was at a community center and they were like ‘can we be in the conversation’ and they brought a lot of insight (Karen Banks).
Banks was involved in the grant application process from the outset, having been brought in as a consultant for the project due to her substantial community connections and background in facilitation. The final grant application proposed a STEM platform school designed to foster development and dissemination of innovative educational practices and a regional STEM hub, described in the application as a “catalyst” designed to increase STEM educational capacity and improve student performance in the region through school and community involvement. The two were described as separate but interconnected entities, with distinct, but overlapping goals. The final application represented Smith County and fifteen surrounding, mostly rural, counties. A total of 47 partners, including non-profit civic organizations, health care organizations, industry associations, chambers of commerce, and post-secondary and school district leaders, signed the initial funding proposal and the ESCP was awarded two year grant funding in 2011.

**STEM school structure.** The Smith County STEM Academy, housed at Eastville State Community College, opened its doors in 2012 to a freshman class of 75. The school acts as an open-access magnet school, in which the only academic qualification necessary is completion of the eighth grade. Seats are filled by lottery, with seats allocated to regional schools on the basis of population. A grade will be added to the school each year until grades 9-12 are represented, and, at the time of this study, 9th and 10th grade students attended the school. The principal, Dr. Arthur Spring, is a published author in the field of educational innovations and has an engineering degree in addition to advanced degrees in education.

The school was designed according to a number of design principles articulated in the hub’s initial proposal to the state. The principles that guided the development of the Smith County STEM Academy include the formation and maintenance of robust partnerships as well as a focus on project-based and problem-based learning (PBL), an integrated curriculum, and a
reflection of regional attributes and needs. The school features a number of curricular innovations including 1:1 computing, a “physics first” approach in which students take physics in their freshman year, and a focus on project-based learning. A unit curriculum design approach uses PBL and inquiry-based learning focused on science, technology, engineering, arts, mathematics, and medicine (STEAM²). All students will be expected to complete a senior year capstone project based upon an internship or an individual research project.

Collaboration is a priority throughout the school, with collaborative teacher teams and collaborative student groups enacting a curriculum based on 21st century workplace standards. These standards include skills such as communication, organization, critical thinking, workplace skills, and technology use. Additionally, the school uses a blended learning design, strategically incorporating online content to allow students to self-pace their progress and permit time to for collaborative student-teacher work.

The grant application noted a two-year funding stream as follows: $1 million from the grant; $450,000 from the Smith County school district, $860,000 from ESCC, $2,500 from SUE, and $430,000 from regional businesses. This provided just over $2.7 million for the first two years’ operation of the school, and the budget documents in the grant application noted that there would be a surplus of approximately $500,000 after expenses. Local school districts will continue to provide funding to the school after the grant funding expires, and Eastville State Community College has made an ongoing commitment to house the school and make capital improvements to the facilities in which it is housed. The grant application noted that the hub will partner with the school to pursue ongoing grant funding.

**Hub structure.** The grant application to the SSCA identified three core design principles for the hub: innovative design features and practices, partnerships to provide innovative student
learning experiences, and strategic positioning to facilitate educational change. The first principle, innovative design features and practices, identified the hub as a catalyst to build educational capacity and incubate and export STEM innovations. Several key priorities were identified within this principle, including a STEM Teaching Fellows program, a STEM Leadership Fellows program, STEM School Certification, an online resource repository, professional development, and STEM informal learning. The second design principle focused on partnerships to foster educational innovation. Partner contributions were expected to include technological and curricular support for STEM innovations, including PBL; internships and cooperative learning opportunities for students; engaging pre-service teachers in curricular design and STEM teaching; disseminating STEM programs across the region; and support in grant identification and writing. The third principle stipulated that the hub would be managed from within the RFE and staffed with the goal of facilitating educational change in the region. The following sections will discuss the hub’s intermediary leadership and staffing and funding.

Intermediary leadership. The grant application stipulated that the ESCP hub would be coordinated and housed at the RFE, which was to act as the fiscal agent for the hub. Since the RFE lies outside of the public education system and is not affiliated with a single stakeholder group, it accords Honig’s (2004) description of an intermediary organization as one that occupies a neutral territory between groups and acts as a change mediator.

The grant application cited RFE’s long history of commitment to educational improvement based upon research-based practices. Sheila Woodford, hub Learning Director, reflected on the various benefits of housing the hub at the RFE, and said, we do have some administrative support through [RFE]. And more than administrative support…all the fiscal responsibilities come through [RFE] and that’s been hugely
helpful, I mean to have the nonprofit status and to have a director of finance to handle the pretty amazing amount of paperwork (Sheila Woodford).

At the time of this study, 25% of RFE’s budget was allocated to STEM education, and contributors to the hub included a major Internet retailer, a scientific supply company, a regional economic development organization, and the local Rotary Club. The RFE was positioned to offer not only administrative support but also fund raising capabilities to the ESCP hub. This will be essential to the hub’s sustainability since the initial grant funding was due to expire two months after completion of this study. Woodford compared the RFE-based structure with other hubs throughout the state and said, “The ones that are located in school districts…funding is a huge issue because they just don’t have that structure.”

A 32-member Advisory Board was designed to provide support and direction to staff members. The board membership represents business, community and non-profit organizations, regional schools, and two and four-year post-secondary organizations. During the initial months of the grant, the board was convened monthly, although at the time of this study meetings were held quarterly. Staff members “have struggled a little bit with that group because we really would like for them to be a [board] that advises. What it ends up being is us telling them what we’re doing and they just kind of nod” (Sheila Woodford). Woodford went on to reflect that hub staff reconsidered the role of the board after the first months of the ESCP’s operation, and chose to use the membership more strategically by calling on members with specific competencies on an as-needed basis. For example, she said, “like when we need help with marketing, we call on this person from the Chamber” (Sheila Woodford).

Staff. The grant application identified three staff positions for the hub: a Director, a Director of Partnerships, and a Program Assistant. After her successful facilitation of the grant-
writing process, Karen Banks was hired as Interim Director. The original intent was to fill the Managing Director position with an educator to “do a lot of…professional development and have the expertise that school systems would trust what they were saying about STEM” (Karen Banks). Banks was an entrepreneur in the information technologies sector before becoming involved in organizational facilitation and has a degree in computer science as well as a Masters’ degree in business administration. Banks reflected that the Advisory Board and the RFE Executive Director began to see the value of having a businessperson in the position and she was hired as Managing Director. Banks described her role as someone who can “bring business to the table and kind of speak their language, but then also understand enough about the education side to know what’s feasible and…how far we can push the limits in doing something different.”

Since the hub recognized the importance of employing an educator to carry out the essential task of professional development in the hub, however, the Advisory Board revamped the original staffing plan, adding the position of Learning Director. This new staffing structure effectively merged the Director of Partnerships role with the Managing Director position, and relied on RFE administrative staff for Program Assistant support. Banks, as Managing Director was charged with partnership development, communication with the larger community, securing funds for sustainability, managing budgets and grants, and working with STEM school leadership. Banks expressed her intention to step down from her position at the end of the funding period for personal reasons.

Sheila Woodford was hired as Learning Director three months after the grant was awarded. She came to education as a second career, after working in industry as a scientist, and was involved with alternative licensure programs in another state before moving to Eastville. Her mixed background in education and industry shapes her perspective, and she said of her ten
years of high school teaching experience, “I really saw, number one, the disconnect between the work of scientists…it in the workforce and what we were – how we were teaching kids” (Sheila Woodford). Her experience working with career-switching teachers, inquiry teaching and learning, and student research experiences made her a good fit for the Learning Director position. Woodford’s job responsibilities include organizing professional development programs, cultivating relationships with business partners, and assisting in securing funding for hub sustainability.

The end of the grant-funding phase will bring about staffing changes. Instead of the dual directorship structure that marked the initiation phase of the hub, the Learning Director will assume all directorship duties and a full-time administrative coordinator will be added to support the hub’s work (Sustainability Plan).

Hub funding. Budget documents included with the grant application include the following revenue streams for the ESCP hub: $850,000 in grant funds; $110,000 from the RFE; $20,000 from SUE; and $205,000 from regional businesses. The total revenue for the first two years of operation was estimated at $1,185,000 with a surplus after expenses of $428,000.

Because the grant funding ends in spring 2014, RFE worked with hub staff and the ESCP Advisory Board to create a sustainability plan based upon three phases of hub activities. The initial, two-year grant period is labeled the “seeding” period for the STEM movement and involved program implementation and community-wide education about STEM education. This phase was fully funded by grant funds. The sustainability plan labels the next phase of hub activities, encompassing July 2014 – December 2017, as the expansion phase, with a goal of expanding programs, supporting educational institutions in creating sustainable STEM models, and establishing the region as a model for excellence in collaborative STEM initiatives. The
The estimated budget for this phase is $1.1 million. Phase 3, from January 2018 – December 2020, is called the cultivation phase in the plan, and focuses on “seamlessly integrating STEM into the fabric of our region’s educational philosophy” (Sustainability Plan). This phase focuses on carrying forward partnerships and best practices, and the budget is estimated at $430,000.

In response to the approximately $1.4 million in unmet funding needs, the RFE launched an “Ignite STEM in the Eastville Region Campaign” (Sustainability Plan) that focuses on grants, sponsorships, and individual donations. The major expenses of the hub are forecast to be hub personnel, stipends for the STEM Teaching Fellows program, staff travel expenses for professional development and networking, professional development materials, and meeting expenses. The Sustainability Plan estimates that annual budget needs will be approximately $265,000.

The Sustainability Plan also proposes monetizing some of the ESCP hub’s services. For instance, school districts may be charged fees for professional development activities and STEM Teaching Fellow expenses. Woodford noted that the hub’s professional development services have acquired “credibility” in the region and forecasts that future funding “will be more programmatic.” She forecasted that “what it looks like right now is we won’t have the flexibility we’ve had to accomplish all those outcomes…My time, for example, will be more prescribed by the way the funding sources work” (Sheila Woodford).

**Goals.** Banks noted that the initial goals for the hub were “very explicit.” The grant application contained appendices outlining goals with specific associated activities and responsibilities. Woodford reflected on the development of the hub’s goals as articulated in the grant application; “there were task force-y kind of groups that took on different parts of the grant writing process and ended up coming up with our amazing list of outcomes and goals for
The hub.” She also admitted, however, that the diversity of groups involved in the process created a daunting list of goals for staff members.

The goals for the hub included supporting the STEM school and maximizing regional impact by connecting and mobilizing STEM assets, and importing and exporting innovations in STEM teaching and learning. A broad range of activities were associated with these goals, including:

- Developing a STEM Teaching Fellows program
- Developing a STEM Leadership Fellows program
- Providing professional development and coaching
- Developing STEM Learning Units
- Developing STEM Student Councils
- Offering STEM summer camps for K-12 students
- Partnering with community organizations and business to expand out-of-school time STEM activities
- Engaging post-secondary students via focus groups, service learning, and supervised teaching experiences
- Developing a resource repository on the hub’s website
- Convening task forces for STEM Resources, STEM Advocacy and Communications
- Developing a STEM School Certification Process
- Developing a rubric to assess STEM quality across grades

Banks recognized the need to communicate the goals of the hub in a succinct way. She said “we put all this stuff in a grant; we said we’re going to do all these things, but if I had to tell
somebody in 30 seconds or less, you know, what we do, how on earth would I say that?”

Woodford credited Banks with being “a master at...synthesizing her message…we wanted a very
simple message that was easy for people to understand.” Banks did, indeed, synthesize the range
of goals when she consolidated the hub’s goals into what she calls “three buckets.” She
identified the three areas of activity as: informing the public about STEM, engaging partners to
support STEM learning, and training educators on STEM best practices.

Eighteen months into the hub’s work, Banks reflected that, “[initially] we had really clear
goals with the grant, and now we don’t have that as much” since many of the grant-related goals
had been achieved. The hub maintained a clear focus on the three “buckets” of work, however,
and Woodford reiterated the hub’s goals as follows:

[First], that the community would know what STEM is, understand what’s important and
understand the economic development implications of it, [second], that we – those
partnerships are happening and they’re integral to how schools function and how
businesses are engaged and informal ed is engaged. And then, third, that teachers know
and are practicing best practices (Sheila Woodford).

Banks focused on the crucial role of partnerships when she said, “Fundamentally what we’re
trying to do is bring industry and education and post-secondary together” and noted the ultimate
goal of institutionalizing the partnership culture in STEM education in the region. Woodford
also offered a long-range view of the hub’s work when she said,

The vision would be that one day the hub would not exist. I mean, if I look to the
future…these would be things that just happen and we no longer have to call it STEM,
honestly, because we really have a global definition of STEM (Sheila Woodford).
Outcomes. Banks noted, “we have a big huge spreadsheet that we use to determine [if we] are we meeting our outcomes. And so what has evolved to now is we basically achieved all those outcomes.” When asked about major achievements to date, Banks cited a successful communications campaign, “getting for the most part the community to understand what STEM is” via televised public service announcements and what she describes as a “media blitz.” She went on to add that the hub has achieved credibility with the area schools and noted, “the reputation that we have in terms of P.D. quality has been a huge success.” Banks also noted a number of what she called “offshoots” as successful outcomes of the hub’s work. In particular, she noted the one-to-one technology initiative launched at the STEM school that has spread to six Smith County schools and the region’s involvement in the Harvard University-based Pathways to Prosperity initiative as legacies of the hub.

Woodford echoed Banks’ sentiments regarding achievements in public communication and professional development services. She noted that, due to the hub’s work, “there is a greater awareness of STEM and its importance,” and that “people are thinking differently about P.D. for teachers” (Sheila Woodford). She also reported that the hub has provided professional development service to between 500 and 1000 teachers and informal educators.

Although neither Banks nor Woodford specifically mentioned partner engagement when questioned about the hub’s accomplishments, it was clear that this has been an area of focus and success for the hub. Banks and Woodford both referred to a teacher job shadowing program as a success of the hub and Banks noted that she would not hesitate to “call up somebody [in business] and be like you know, we’d really love to partner with you on X. Can I come in and talk to you about it?” The payoffs from this approach have been, as Banks said,
When we pull partners in and we make those connections to the schools that are, you know - that are, you know, authentic learning experiences for both the teachers and the students, we're giving teachers an exposure to workforce that they haven't had in many cases before. So I think that that's a huge value is those soft skills and just an understanding of what the modern day workforce really looks like for the people that are in fact preparing the modern workforce (Karen Banks).

Woodford particularly noted the advantage of having a flexible strategy to engage businesses, relying on individual organizations’ strengths. She said that there are “many [business partners] but they serve in different capacities,” (Sheila Woodford) including hosting teachers for job shadowing, serving on the STEM Advisory Board, and donating employee time for events.

The STEM Student Council was another means by which the hub forged connections between the K-12 and business sectors. The approximately forty students on the Council represented twenty regional schools and were grouped into teams around common interests, each of which collaborated with two business sector mentors with competencies related to the team’s interest area. Team projects included educational programs for elementary age children, public relations materials to spread news about STEM education around the region, and projects to engage businesses leaders in discussions about STEM education and workforce needs. While Banks and Woodford facilitated the initial conversations between the student groups and mentors, the groups were largely autonomous and planned their own work.

The staff’s strategic use of resources and the need for flexibility became apparent when they discussed the goals listed in the grant application. Woodford noted some departures from the grant-based outcomes due to circumstances and limited resources. For instance, she pointed out that two initiatives have been impeded by state policies. After the grant was approved, staff
learned that STEM school certification was against state regulations although it was one of the
goals expressed in the grant application. Additionally, the goal of providing student internships
and work-based learning experiences turned out to be unachievable in the near-term since, as
Woodford noted “doors are closed to student because of liability issues and all these rules and
[regulations].” Although that goal was tabled at the time of this study, Woodford noted a
positive aspect of its inclusion in the grant application when she said that, “I really think our
work has influenced the state to start to really re-look at some of those workplace learning
experiences.” Neither did the planned task forces for resources, advocacy, and higher education
emerge as planned, serving instead in a needs-based rather than formative capacity according to
Woodford. The original intent was for these groups to act as sub-sets of the Advisory Board,
however Banks and Woodford soon realized that these groups were subject to the same
shortcomings in advisory capacity as the Advisory Board itself. Woodford said, “we would
convene them, have usually conference calls, and talk about it and it would be crickets on the
other end of the line. And so…we ended up…reaching out to those individuals when we have
things arise.”

Likewise, Banks noted the need to use limited resources strategically when she described
how a planned newsletter distributed to stakeholders was scuttled after two issues when data
showed that very few stakeholders actually opened it. She and Woodford decided, “we can’t
maintain this if it’s going to get this type of return, especially when we have two people
and…that was when we were really starting to pick up the P.D.” (Karen Banks). Woodford
traded her time on the newsletter for site visits with superintendents across the district, which,
she said, “actually gave us a lot more traction” for professional development and other hub
activities.
Conclusion, research question 1. The ESCP hub was characterized by its strong focus on partnership and wide base of community support. The staffing structure acted as a metaphor for the way the hub functioned, with its deeply intertwined business and education orientations. The hub was therefore positioned to act as a connector between sectors, facilitating relationships and identifying points of convergent interests between education and other stakeholder groups.

Research Question 2

The second research question focuses on partners’ perceptions of the hub’s progress by asking, How do partners perceive the partnership’s progress toward creating an infrastructure for change as defined by its progress in the five characteristics of collective impact organizations? Partners were asked a series of questions designed to understand their personal and organizational involvement in the hub and to understand their perspectives on the hub’s performance in each of the five characteristics of collective impact organizations, common agenda, shared measurement, mutually reinforcing activities, continuous communication, and backbone support. Each of these themes will be discussed in the following sections. A brief definition of each theme will be offered, and then partner perspectives on each theme will be discussed.

Common Agenda. Kania and Kramer (2013) described one factor of success for collective impact organization as the ability to formulate a common agenda, shared among stakeholders, that culminates in a shared vision for change. Collective impact organizations arrive at this shared vision through a common understanding of the problem at hand and seek change via an agreed upon approach and actions.

The community-based approach to the ESCP grant writing process was evidence that the hub was formed from a foundational understanding of the importance of a common agenda. The
following sections will review the common agenda characteristic of collective impact by examining partner perspectives on the understanding of the problem the partnership addresses, the hub’s approach to implementing change in STEM education in the region and, finally, the vision for the change to be accomplished.

**Common understanding of the problem.** The hub’s website describes the problem facing the region as follows: “Our local businesses are struggling to fill good-paying jobs requiring strong skills in science, technology, engineering and math. Yet our students’ test scores show they are not prepared to take on these jobs.” This dual focus on local labor market needs coupled with evidence of a lack of educational capacity in STEM is echoed in partners’ understanding of the problem the hub addresses. Interview participants identified the problem as either workforce needs, lack of STEM educational capacity, or some combination of the two. Perspectives aligned with stakeholder groups, not surprisingly, with business participants focusing on employer needs and educators referring to educational capacity and its links to labor market skills.

Business partners defined the problem in terms of employer needs. Mike Lewellen, from the regional chamber of commerce, spoke for regional employers when he said “So we spend a lot of time talking to the business community about what they’re looking for qualified employees and STEM is one of the answers to that question.” Colin Taylor echoed this sentiment, referring his company’s concern for “having a 21st century workforce ready for us.”

K-12 educators also cited workforce needs, but in a more focused, skill-oriented context that implied a need for increased educational capacity. Computer science teacher Nick Browning stated, “we’re clearly not preparing our students for 21st century jobs,” and science teacher Roger Potts cited the need to “improve skills that students graduate with in order to get
jobs for which problem-solving and creative thinking are useful – and those are not just science and engineering jobs.” Community college dean Charles Stafford spoke of the need for a system where “every student had the opportunity to be involved in all of the great things that are happening…whether it’s curriculum design or technology or, you know, work-based…mentorships, things like that.” Likewise, David Marsh noted the critical role of early education and the need to “instill science, learning principles at an early age” and to “educate young folks that are going to go out into the business world potentially.”

Laura Smithson offered a more nuanced assessment of the problem when she tied the lack of educational capacity directly to workforce needs. She began by saying, “Our students are not as successful in traditional STEM areas as they could [be]” and followed later by citing workplace demands, along with the complexity of combining uncertain future employer needs with potential student mobility, saying

We are no longer a – a society that grows up and lives here and dies here and stays in one place. So the idea of recognizing the value of those skills, because you’re going to be in a very different place when you grow up - you can’t expect to live and work right down the street from where you used to – you’re cognizant of demands of the workplace, future expectations of employers (Laura Smithson).

One community group participant tied larger educational funding issues to the need for innovative structures such as the ESCP hub. He noted that inadequate school funding is “one of the elephants in the room” (Victor Houseman) that contributes to difficulties in providing quality STEM education throughout the state. Although he spoke to educational funding on a statewide scale, Houseman particularly noted the potential of the hub to leverage additional funds for STEM education.
Agreed upon approach and actions. Hub staff identified their approach within three distinct “buckets” of work – inform, engage, and train. While most partners did not use this language, there was significant agreement among partners regarding the hub’s strategies for achieving their goals. Two themes for hub strategies were identified in partner interview data. One, incubate and disseminate, aligns well with the hub’s educator training role and with role of informing the public about the hub’s work. The other theme identified, connect, is aligned with the hub’s work to engage partners.

Incubate and disseminate. Several partners expressed a belief that the hub was intended to build regional capacity for STEM education by acting as an incubator for innovative educational ideas that would be dispersed regionally via the hub school and professional development programs. This is evidenced in the Colin Taylor’s description of the hub as a “clearinghouse” and in Charles Stafford’s description of the hub’s processes as “resources coming in…and ideas coming out.” Indeed, Roger Potts’ Polymerase Chain Reaction metaphor for the hub’s work captured the idea that STEM teaching practices and innovations would spread throughout the region as increasing numbers of educators and other partners adopted and modeled these practices, resulting in what Colin Taylor described as a “region of STEM capabilities.”

The STE school, in particular, was viewed as a primary mechanism for incubation and dissemination. Mike Lewellen described one goal of the hub as “using the school as an incubator for best practices that could then be implemented in other places.” Colin Taylor noted that the hub would act as a forum to “disseminate that learning throughout the region.” Charles Stafford furthermore noted, “what we didn’t want was that this STEM concept was going to be just for these 300 students at this one school…but to make it region wide.” Roger Potts echoed
the importance of disseminating STEM best practices throughout the region and noted that rather than growing particular programs, the hub is “furthering out this idea that STEM is – is how you do things, not exactly what you do.” He went on to cite the example of the STEM fellows, saying, “by showing what they’re doing in their classrooms and students being excited…other teachers will notice and may want to engage in using some of [the STEM teaching practices]” (Roger Potts).

Besides disseminating educational best practices throughout the region, Laura Smithson noted the importance of public understanding of the importance of STEM education when she said, “I think their vision is to take advantage of the opportunity to make STEM more visible and to make sure everyone understands the – the importance of these different skills and areas of knowledge.” Likewise, Mike Lewellen noted the hub’s efforts to “develop a collective community vision” of STEM education in order to create a sense of community-wide “ownership” for the work of STEM education reform.

The incubate and disseminate theme was not as explicitly apparent in community group perspectives. It is important to note that both participants from this stakeholder group represented organizations that they identified as providing informal education opportunities, and both saw value in aligning their programs with K-12 curriculum and standards. Although their focus was more on the connections that the hub afforded them with K-12 schools, their comments regarding the value of the hub’s professional development activities alluded to the role of the hub in incubating and disseminating educational best practices. In particular, Victor Houseman said that museum staff have participated in hub professional development events that focused on aligning their educational content with school science standards.
Connect. All participants expressed strongly that a key hub strategy was to connect partners across stakeholder groups throughout the community. This was evidenced by a variety of words used to describe the hub’s role. Among these were “matchmaking” (Roger Potts); “networking agency” (Victor Houseman); “connector” (David Marsh); “rich way to share experiences” across sectors (Colin Taylor); and “integrate” (Mike Lewellen).

In particular, connections between the business community and the K-12 schools were a theme that emerged from interviews. Mike Lewellen referred to this role as “bridging gaps.” Victor Houseman said, “really the STEM hub’s mission is to connect, I’d say, business…education and informal education really.” Roger Potts cited the difficulties that K-12 educators may experience in connecting with business community stakeholders, saying, “there are enormous barriers for teachers doing anything out of the ordinary,” and credited the ESCP hub with facilitating these new relationships. He cited business partnerships for K-12 robotics programs in the region as an example of such connections and noted that the hub was able to negotiate “legal things about working with [schools] that make it a lot easier for you as a teacher to go through your administrative hierarchy and get things done” (Roger Potts).

Shared vision. Roger Potts described the hub’s inception as a collaborative process that “tried to develop a collective community vision with all the partners.” One post-secondary stakeholder gave evidence of the success of that effort when he referenced the school board meeting convened to approve the hub. He said

I have never seen these people in a room together before in my entire life here…I mean, there were people from every entity you can believe that were there to support this project. And that said a lot…There’s really been no dissent…it passed unanimously (Charles Stafford).
Mike Lewellen referred to the hub as “an easy partnership,” but stressed the importance of continuing conversations between stakeholders and of convening “representatives from all of those partners at the table to make sure that we’re all still pushing towards the same goal.”

Partners from three of the four stakeholder groups were able to clearly express a vision for the STEM hub in response to a question regarding the hub’s vision and mission. Interestingly, neither of the informal education participants seemed confident about the mission and vision, however. Victor Houseman responded with the question “Is there an official mission and vision?” while David Marsh reviewed some hub documents and responded with “I don’t really see it.”

Other participants expressed the vision of the hub as the formation of an institutionalized community mindset regarding the importance of STEM education or, as Colin Taylor proposed “a region, if you will, of STEM capabilities.” Nick Browning described the vision as STEM becoming “more than just the subject fields but the mindset behind…the concepts that go into these fields becoming infused in how we teach every day.” Laura Smithson felt that the hub’s vision was to be “larger than the schools” and to “elevate [STEM education] to the point that people understand the value and recognize it.”

In spite of Victor Houseman’s initial uncertainty regarding the question, he returned to the question of vision later in the interview, saying, “I interpret the vision to be a community that embraces STEM education.” David Marsh also expressed his understanding of the hub’s vision after his initial confusion and related it to wide-scale regional economic development. He described the role of the hub as follows:

If we’re able to give young people…the tools necessary to be more prosperous in their own neighborhoods, maybe they’ll stay here. Maybe they’ll reinvest in their
neighborhood. Maybe we will see new businesses appearing, new technology being brought. (David Marsh).

**Discussion: Common agenda.** Partner perspectives regarding the hub’s goals had a common thread regarding the need to prepare students for future workforce needs in the region. Although partners diverged somewhat along stakeholder lines in their understanding of the problem the hub addressed, all perspectives were oriented toward building educational capacity to enhance student preparation for college and career. Although community group stakeholders failed to explicitly identify the hub’s incubate and disseminate strategy, their acknowledgement of the value of including informal educators in professional development activities was a tacit acknowledgement of this hub role.

Two participants’ comments raised questions about policy paradox (Mitra & Hilabi, 2012) by referencing the long-term mobility of students versus the need to prepare a workforce for the local region. Laura Smithson’s comments regarding the value of hub programs in recognizing that “you can't expect to live and work right down the street from where you used to” stand in contrast to David Marsh’s perspective about encouraging young people to remain in the area by providing them with “the tools necessary to be more prosperous in their own neighborhoods.” This suggests that the hub may benefit from attending more closely to this paradox to ensure that students, parents, and educators do not receive the mixed workforce preparation signals that Mitra and Hilabi (2012) reported.

**Shared Measurement.** Consistent data collection and measurement of results are hallmarks of collective impact organizations (Kania & Kramer, 2013). These data collection efforts, extending across the partnership, ensure that the partners’ work remains focused on its goals, and provides a mechanism for accountability between partners and the backbone
organization providing leadership (Kania & Kramer, 2013). While Kania and Kramer noted the critical role of shared measurement systems to track progress in collective impact initiatives, they acknowledged that such systems are typically geared toward “tracking longitudinal quantitative indicators of success” (p. 5) and that supplementing such systems with “developmental evaluation can provide an important complement…by providing the critical ‘how’ and ‘why’” (p. 5).

The ESCP recognized the importance of data as evidenced in the quantitative goals delineated in the grant application work plan. Outcomes measures for the hub in the grant application included ensuring that all teachers in the STEM school participate in at least thirty hours of professional development per year, identifying at least eight strategies for sharing innovations within the ESCP and throughout the SSCA, and ensuring that at least 500 K-12 students per year have access to additional STEM learning opportunities. Hub staff members have been accountable to the SSCA for their goals and “report out” (Sheila Woodford) on a regular basis. Additionally, staff reported keeping records of descriptive data, including numbers of students and teachers exposed to programs. Woodford referenced utilizing the RFE’s research staff to administer surveys and sharing data informally with school district leadership. Beyond the goals set forward in the grant, however, Karen Banks noted that “we don’t have what I feel is a really solid measurement metric system in place” and recognized the need to develop a sustainable metrics system that will outlive the initial grant period. Indeed, one of the challenges for the ESCP moving forward will be not only to develop a metrics system, but also to forge agreement on what should be measured. Banks reflected several partners’ perspectives when she said, of using student test scores as an outcomes measure, “I just don’t think there’s authenticity in that…and so I don’t know if [the measurement system] will be more school oriented or it it’ll
be more partner oriented” although she added that “measuring the number and quality of those partner interactions that we have” will be an important component.

Staff comments regarding measurement systems were echoed in partner perspectives. Three sub-themes emerged from interview data: uncertainty, the role of qualitative versus quantitative data, and the need for a long-term focus in outcomes measurement. These sub-themes are discussed in the following sections.

**Uncertainty.** Several partners expressed uncertainty about how data was collected and progress measured within the hub. Comments such as “I have to admit I don’t know what they do to measure their progress” (Charles Stafford), “I don’t have information on it” (Nick Browning), and “I’m not sure how they measure” (Victor Houseman) were typical when participants were asked about how the hub measures its progress. When asked if they shared any data with the hub regarding their participation, no partners claimed knowledge of data sharing specific to hub activities.

Partners felt further uncertainty about what should be measured regarding the hub’s progress. Colin Taylor pondered whether using student tests score improvements or numbers of students participating in STEM activities would be useful measures, but concluded, “You know, I really don’t know if that’s part of how we would measure.” Roger Potts recognized the difficulties of measuring hub progress when he said

> Oh, boy, how would you measure? I mean there’s some concrete things you can measure in terms of events that were going on, how many partners were in schools in a year….what’s harder to measure is what’s going on in the schools….it’s a tough one (Roger Potts).
Potts went on to point out that the desired outcomes are “complex and varied” and called into question whether a useful metrics system is even feasible. He questioned whether it is “worth paying somebody....$60,000 a year and....half of their job is to figure out how to measure everything, you know. And then the time you’re going to be taking from all the partners to give data – I don’t know.” He concluded that a metrics system is likely to be “doomed to be pretty incomplete” and “I wouldn’t get carried away with it” (Roger Potts).

**Qualitative versus quantitative data.** While Potts was the only participant to question the usefulness of any data collection system, several participants opposed the notion of using standardized test data as an indicator of hub progress. Nick Browning was the most outspoken on the issue, saying “I’m very opposed to using student test scores to track progress…and [the hub] seems to agree with that….that was the deciding factor for me to participate with them.” While Laura Smithson admitted that “typical educational numbers” including standardized test scores would probably be a part of a data collection system for the hub in the long term, she emphasized the greater importance of qualitative data including student attitudes, willingness of business partners to engage with schools, and personal connections within the hub, although she added that these “are not necessarily as measurable.” David Marsh also alluded to the need for qualitative data as a measure of hub success. He said,

> I understand where these young folks are coming from and...I understand sometimes you can’t measure certain things. And I see that when we have all these schools that are driven by results and tests and that were then saying these kids are underperforming....It’s the outcomes [that matter]....it’s real outcomes on individuals (David Marsh).

Although there was a sense among participants that quantitative data in terms of event participation and student tests scores were inadequate measures of hub success, they had few
concrete suggestions regarding alternative data sources. Comments indicated, however, that a qualitative component would add value to assessments of the hub’s work.

**Long-term focus.** Participants as a whole seemed to recognize that the hub’s goals encompass long-term objectives such as student post-secondary attendance and providing a STEM-skilled workforce. Consequently, partners admitted that short-term data collection efforts would be incomplete. Mike Lewellen reflected the business sector perspective when he commented on this issue. He said,

> We take the long view in this – we’re not going to solve our particular problem overnight and our particular problem is we want to make sure we have graduates…that are qualified to go to work. So for us, the ultimate measure will be – are our STEM graduates qualified to go to work? And we won’t know the answer to that question for three more years because we don’t have the first graduates for three more years (Mike Lewellen).

He also suggested that long-term measures including employer perspectives on STEM school graduates’ workplace performance could be a part of an overall metrics system.

Roger Potts weighed in on the possibilities of longitudinal metrics systems as well, suggesting that data regarding students’ choices of college major could be a contributor, however he recognized the difficulty of implementing such systems and said “Getting that data and putting it together? I wouldn’t want that job.” Nick Browning also spoke to student attitudes toward STEM subjects and careers as a potentially useful metric and suggests looking at “schools, student populations – and looking to see if there is going to be a shift…is there actually some change that is happening?”

**Discussion: Shared measurement.** Interview data indicated that the lack of comprehensive data collection in the hub may reflect a prevailing uncertainty on how and what
to measure. While there has been some effort to collect developmental data (Kania & Kramer, 2013) in the form of descriptive statistics regarding hub programs, the ESCP’s limited efforts at data collection reflected the limited staffing for the hub and the uncertainty inherent in future staff capabilities. Added to this is a lack of consensus among partners about if and how school level data should be used. While the hub is able to leverage the RFE’s infrastructure for data collection and analysis, this has been used to date in a limited ways such as pre and post surveys for professional development programs (Sheila Woodford). Indeed, Karen Banks specifically addressed the time-intensive component of devising a comprehensive data collection system and admitted that, while implementing a metrics system is important, the effort has been delayed in favor of more urgent priorities. The impending changes in the hub staff and the possibility of changes in the hub’s focus after the initial grant period ends adds another layer of complexity to long or short-term data collection efforts.

The hub was able to articulate short term, developmental goals in the initial grant application to the SSCA, however extending those to measurable long-term success indicators has proved to be a more elusive task. Measurable progress and goals may be important to the hub’s public relations strategy as it implements its sustainability plan. First, however, partners will need to reach an agreement regarding if and how school-level data will be used.

**Mutually Reinforcing Activities.** Effective collective impact organizations leverage the individual competencies of partner organizations to create a complementary set of activities coordinated by a central backbone structure (Kania & Kramer, 2013). Partner activities should be coordinated in a way that is at once intentional and flexible, embracing a sense of emergence, in which problems are approached in a manner that is “rigorous and disciplined and, at the same time, flexible and organic” (Kania & Kramer, 2013, p. 6).
This combination of intentionality and flexibility was captured in hub staff’s descriptions of partner roles. Banks reflected on the “learning process” she and Woodford experienced, citing an initial partner engagement model that offered stakeholders a menu of four ways to interact in the hub’s activities. Banks went on to say of the structured engagement model “while it was kind of helpful to kind of catalyze the conversation, everybody’s unique – [every] organization is very unique and individualized and what we bring is different from everybody else.” She added that engaging partners effectively requires being attuned to their competencies, and described the hub’s engagement strategy as

  don’t just go ask for a donation the concession stand supplies. Go ask for an employer to host a teacher in a job shadow or to come in and work with students in a project, you know, and get them engaged in the learning process a little more” (Karen Banks).

Banks alluded to the complementary nature of activities when she said that partner roles in the ESCP are “about what they need and what you need to be able to be responsive” citing the need to “change and modify and grow” in relationships with partners. Likewise, when asked how partner roles in the hub are defined, Woodford responded “they’re pretty much defined by Karen and I…because we are the ones bringing them together and that definition can change.”

Several sub-themes emerged from partner interview data within the theme of mutually reinforcing activities. Partners were particularly attuned to the coordinating role that hub staff have in partner activities although, while partners were familiar with their own role within the hub, some admitted a lack of understanding of the roles of other stakeholder groups, particularly that of the four year university. Other sub-themes that emerged from partner interview data were strategic use of limited resources and mutual learning and cooperation.
**Hub as coordinator.** David Marsh described the role of the hub in coordinating partner activities using an analogy of the behind-the-scenes coordination required to provide cable television service. He described the need for technicians to locate a home using GPS, then dispatching coordinates to a technician to find the home, followed by the machinations involved in creating monthly billing and said “somehow it’s all connected. Somehow the service is being delivered…so it’s all making sense…I mean, this partnership is sort of a – almost like an organic being…there are moving parts, you know?”

While the hub’s role as connector will be discussed in more depth in the analysis of the backbone support theme, partners conceptualized this as a key strategy of the ESCP in coordinating the partnership’s work, and this role was mentioned repeatedly in the interviews. Colin Taylor, for instance, described the hub staff’s strategy with partners as one of “socialization” and “facilitation.” Roger Potts echoed this description, saying of hub staff that “they make connections. They put people together.” Charles Stafford noted the importance of the hub in coordinating activities, and said “it’s why the hub idea is great because it actually assigns a person or a team of people to be in charge of that.” Victor Houseman described the hub as a “networking agency,” bringing together individuals from disparate stakeholder groups.

**Partner roles.** Interview participants generally expressed clarity about the differentiation of roles within the hub and many placed a particular emphasis on the role of business sector partners. Even so, the complexity of partner roles was apparent in the interviews with descriptions using terms such as “multifaceted” (Nick Browning) used to describe the roles. David Marsh captured some of the complexity of roles and relationships within the hub when he reflected that “we’re all customers to each other.” Perceptions of the role of each stakeholder group will be provided in the following sections.
**K-12 role.** When participants were asked how they understood various partner roles, most had little to say explicitly about the role of K-12 schools in the hub. Those partners who commented on the K-12 role focused on either student support or on K-12 as a part of the workforce development process.

Victor Houseman’s response indicated that he felt the self-apparent role of K-12 in the hub required little comment. He responded, “obviously, the educators’ primary role is the student.” Colin Taylor expanded on this role when he identified the role of K-12 as bringing “the raw material…they [schools] know who are the targets and how to deliver.” Charles Stafford’s response indicated his deep involvement with the STEM school, located on his institution’s campus. He conceptualized the role of the platform school as an idea incubator where educational innovations will be disseminated to students across the region. Nick Browning also commented on the importance of K-12’s role in disseminating educational best practices across the region and referenced professional development workshops he led in conjunction with the STEM school principal. Roger Potts used the analogy of “evangelism” for this role of disseminating innovations, and advocated for the role of K-12 educators in providing “example and models rather than…dictates and mandates.”

Browning’s comments also reflected a workforce development perspective when he said, “We in K-12, we’re just not prepared for business. We’re preparing for business by way of, for the most part, postsecondary education. And so we have a- kind of dual responsibility there.” Mike Lewellen’s comments indicated that his perspective that K-12’s role in the hub is to engage with the business community. He said, at the end of the day, the business community is the one who’s employing the end product of the K-12 education system…so how can you assure that you’re creating a
good product through the K-12 system without asking your employers what they’re
looking for? (Mike Lewellen)

Laura Smithson likewise commented, that preparing students for the workforce requires ongoing
conversations between the education and business sectors, and recognized that schools are
“preparing [students] for a field that is constantly and rapidly changing.”

Community group role. The role of community groups was understood to be in the realm
of informal education, and as a complement and supplement to the formal K-12 system through
the hub’s work. Roger Potts reflected on the need to integrate informal education with public
education “as an integrated effort.” Victor Houseman spoke to the informal educator’s
perspective when he expressed that his organization’s role is “to support teachers and figure out
how our resources can be used within the schools.” David Marsh also reflected the
complementary nature of informal education organizations’ roles when he said that “it behooves
us to…support what’s going on in the in-school time…after school and beyond is a big
movement.”

Both Houseman and Marsh mentioned the professional development opportunities the
hub provides to informal educators and noted their critical role in facilitating an integrated
approach to STEM education. Houseman specifically noted that these opportunities assisted
museum staff to align programs with science standards and to identify areas of need in school
programming. One result of this is the planned launch of a “STEM classroom on wheels”
(Victor Houseman) that will serve schools in the region.

Business community role. Victor Houseman summarized partner perspectives when he
described industry’s role in “developing a…skilled labor force” and “helping [schools]
understand what are the needs of industry” as well as providing “hands-on opportunities for
The portrayal of the business community as forward-looking and workforce-focused was echoed throughout the interviews. Mike Lewellen spoke on behalf of a consortium of regional businesses in his role with the Chamber of Commerce, and identified three distinct roles for business within the hub. The first was in curriculum design, and he cited the involvement of area professionals in the design of curriculum for the STEM school. Furthermore, business professionals have a role in instructional time according to Lewellen. He held as an example a car-building unit at the STEM school during which an automotive manufacturing engineer worked with students. The third role he cited for the business community was providing work-based learning opportunities for students. He cited as an example a STEM school trip to a national insurance provider’s base of operations.

Laura Smithson expanded upon the business role as a provider of work-based learning opportunities when she commented upon teacher participation in job shadowing programs, saying that “the ability of a teacher to say specifically these are the skills you’re going to need and the ability of a business to say this is what we’re looking [for] gives them a connection that probably didn’t exist before.” Charles Stafford also focused on the role of business in work-based learning, and said “the business partners are giving students and faculty a taste of what it’s like in advanced manufacturing, changing the perception for students and parents.” Likewise, Nick Browning cited his own experience as a STEM Fellow charged with creating a business partnership as part of a practicum experience in which he job shadowed a chief information officer at a local manufacturing center. He concluded that this aspect of the STEM Fellows program was valuable to teachers, since “I think we all had big takeaways, even…with the not so effective ones because if nothing else, it forced us to work through that process of identifying business partners, securing business partners” (Nick Browning).
Post-secondary education role. The post-secondary partners in the hub were ESCC and SUE. Since the STEM school is located on the campus of Eastville State Community College, the role of this two-year institution was clear to most participants. The role of SUE as a partner was less clear to partners, however.

Partners conceptualized ESCC’s role largely in terms of its involvement with the STEM school. Charles Stafford, ESCC Dean, provided a description of his institution’s role in the hub that goes beyond simply providing physical space and infrastructure saying,

I know our role very well here at the community college, and our role is to support those students in their transition from high school to, you know, freshman in college and - and we do that by providing, you know, them information and resources for planning for their long-term educational planning…Also, the college, we provide expertise in curriculum planning and design, you know. For example, we have a curriculum advisory group which is - [which comprises] of department chairs and faculty here that consult with the high school faculty in curriculum development and providing an alignment of skills that those students need.

Mike Lewellen summarized the role of ESCC as follows:

[Eastville State] has been fantastic…the STEM school is on their campus. They donated that property. They’ve fully embraced the curriculum there and have tried to design things that would allow those STEM students to go get a two-year degree pretty seamlessly after they graduate

Partners outside of SUE were generally less clear about that institution’s role in the hub. Laura Smithson, Director of the SUE School of Education described the university’s role in the planning process for the hub as “significant.” She pointed out that the university grants office
wrote a large part of the grant application and noted that several university employees are advisory board members. Perhaps because, as Sheila Woodford noted, there was a great deal of leadership change at SUE, partners from other stakeholder groups did not share this perspective regarding SUE’s role in the hub. Mike Lewellen felt that SUE’s role in the hub was not well defined. Similarly, when asked about partner roles, Roger Potts said, “The outlier to me is always [SUE], where – where are they fitting into this?” Some participants indicated that teacher training is the role of SUE. Victor Houseman concluded his discussion of partner roles by saying, “and then you have the university, which has a whole other level of expertise. But there’s also training teachers. So they have a role there.”

**Strategic use of limited resources.** Hub staff recognized that they could maximize the hub’s impact by engaging partners strategically in activities. Karen Banks shared her philosophy that “engagement is a means to an end,” and noted the old adage that “if you want advice ask somebody for money. If you want money, ask somebody for advice.” This strategy has, according to Banks, resulted not only in financial support from partners, but also in partners exhibiting a deeper level of engagement in their roles. The strategy of capitalizing on partners’ strengths to achieve maximum benefits for the hub was echoed in partner interviews as well.

Mike Lewellen commented that the hub has been able to strategically harness the strengths of the business community to benefit K-12. For example, he says, “don’t go ask a logistics company to paint your building. Why don’t you ask a logistics company to take a look at your bus routes to make them more efficient?”

Charles Stafford also commented that his role was sometimes defined as a connector for purposes of efficiency. He noted that hub staff recognized his connections within school systems and within the community college system and leveraged his connections to efficiently forge new
relationships. Victor Houseman likewise commented that roles in the hub were defined “to leverage their resources to be more effective, be more impactful….so we’re not duplicating.”

**Mutual learning and cooperation.** Partners were open to and aware of opportunities for mutual learning and cooperation among the various stakeholder groups in the hub. Colin Taylor went so far as to describe the relationships among partner groups’ roles as “symbiotic.” He went on to note that the hub provided “a very rich way to share experiences and to share different learning opportunities,” noting that business people learned from educators and vice versa through hub activities. Roger Potts also commented on learning opportunities, saying that the hub helped to create “a professional learning community” throughout the region that transcended individual school-district boundaries.

Laura Smithson emphasized the level of cooperation and group ownership of activities among stakeholders, saying that “nobody sees it as someone else’s job…the thing that has been probably most telling is there is not one group or organization that represents the most valid perspective.” David Marsh summed up the cooperative atmosphere when he said “it takes a village” to do the hub’s work.

**Discussion: Mutually reinforcing activities.** Partners’ descriptions of various stakeholder group’s roles in the hub used relatively vague terms. This may be indicative of the flexible and evolving nature of partner roles in the hub and the needs-based approach of hub staff to engaging partners. In the face of changing hub staffing, however, it may be useful to the hub to operationalize partner engagement to some extent. It is apparent that partners look to hub staff to make connections for them and to lead the conversations between school and business partners, pointing to the strong coordinating role hub staff has played to date. Given that there is varied opinion among partners regarding whether K-12 education or business should initiate
those conversations, it may be useful to operationalize the expectations regarding these relationships so that they can be formed and maintained regardless of the level of involvement of hub leadership.

The general lack of clarity among partners regarding SUE’s role in the hub may be a reflection of the changing, emergent roles of partners. Given the university’s strong role in the grant writing process, SUE may conceptualize its role in terms of technical support, a role that may be difficult for other partners to discern. It does not appear from partner interviews that a new role has clearly emerged for SUE, a step in the organic process of partnership that may have been delayed due to the leadership turnover at the university.

**Continuous Communication.** The fourth characteristic of collective impact organizations, continuous communication, denotes something beyond the number of telephone calls and e-mail messages circulated within the partnership. Instead, it encompasses consistent and open communication and an atmosphere of trust, which, in turn, ensures that partners maintain their focus on the initiative’s objectives (Kania & Kramer, 2013).

The recognition that informal networks undergird the formalized structure informs hub staff’s work. Sheila Woodford described much of hub work as “a kind of personal reaching out” in which staff strategically contacts partners to enlist assistance with particular programs. Karen Banks spoke to the growing networks among hub partners acknowledging that various partners “are all kind of talking on the back end” outside of the formal hub structure. She went on to point out the value of connectivity in the hub and staff’s role in “thinking about who’s missing and how we can make it better by pulling somebody else in” (Karen Banks). Participant comments regarding communication within the hub reflected this strategy of communication and
an additional theme of forging relationships across institutional cultures emerged from interview data.

**Communication strategy.** Partners agreed that hub staff members are accessible and that communication from staff is generally on an as-needed basis, with the hub functioning in a connector role to facilitate partner-to-partner communication. One business partner called the hub’s communication strategy one of “socialization” (Colin Taylor) and noted that Banks and Woodford reach out to school districts and partners to inform them of opportunities such as grants for teachers and to facilitate collaboration. Charles Stafford commented upon the usefulness of a list made available to those involved in hub at its inception as an “electronic rolodex with everybody’s contact information” that allowed him to easily reach out to others in the partnership on his own. Smithson also recognized this networking strategy and commented on the novelty of the “connections and relationships” between diverse stakeholders, offering as an example the opportunity for individuals in higher education to connect with industry representatives at a hub-sponsored business-higher education roundtable. Victor Houseman described the hub’s role in communication as fostering “collaboration and dialogue” between partners. Likewise, David Marsh recognized the importance of the hub in fostering network opportunities and noted that he is able to connect with school administration easily now, whereas in the past he noted that there may have been difficulties identifying and contacting individuals in other sectors, calling the hub’s role in this one of “connecting the dots between the cultural institutions, the business world, and the formal education institutions.”

While continuous communication includes a range of relationship factors, quality of communication from the hub to partners is a key piece of effective communication, and one with which staff admittedly struggles, as evidenced by their failed newsletter attempts. Most
participants were satisfied with the frequency and quality of their communications with the hub and other partners. Several partners felt that quality of communication was more important than quantity, and seemed to appreciate hub staff’s targeted and strategic communication strategy. Mike Lewellen cited his appreciation at being “kept in the loop” and Charles Stafford called the quality of communication “great.” Laura Smithson noted the danger of “information overload” but added that hub staff are sensitive to this and “think about [communication] in a very specific way, to make sure that what they’re doing is going to be viewed by other people as important.” Only one participant expressed any dissatisfaction with the quantity or quality of communication from the hub, saying, “I think we could do a better job on the level of communication…I think more periodic updates outside of the Advisory Board meeting. I think that would be helpful” (Colin Taylor).

**Relationships across institutional cultures.** There was a pervasive feeling among partners interviewed that a culture of mutual learning and cooperation exists between partners and with hub staff. Colin Taylor pointed out that, when he enters a discussion to provide a business perspective, he finds that he may in turn learn from “the perspective of the educator” and noted the importance in the hub of being open to “continuous learning.” Several participants held up the hub inception and grant writing process as an example of cooperation across sectors. Charles Stafford summed up these perspectives when he said that although he had not worked closely with business partners in the past, he found that the hub’s work brought diverse stakeholder groups together since “this is one thing that everybody can get on board with.” Other stakeholders referred to a “good working relationship” (Mike Lewellen, Victor Houseman) among partners.
Roger Potts provided a more nuanced description of relationships in the hub using marriage as a metaphor. He said,

Just like getting married…you need two people that want to be married. And sometimes that takes a longer courtship, you know. Sometimes the courtship fails and you move on because not every pair of partners is going to…work well (Roger Potts).

This acknowledgement of potential difficulties among partner groups was, interestingly, unique to K-12 stakeholders who spoke to the topic of difficulties and discomfort in connecting with other stakeholder groups. Nick Browning also commented upon some pitfalls in relationships across institutional boundaries. In particular, he noted the difficulties K-12 educators face in engaging partners from other sectors. Teachers may lack a sense of self-efficacy in engaging with other stakeholders because of “apprehension” about “professional etiquette” (Nick Browning). He acknowledged that businesses seem eager to be involved, yet said of teachers, “most of us have not worked office jobs and…if you’ve been in the classroom for 25 years, it can be a little intimidating [to contact business people]” (Nick Browning). Furthermore, he noted hesitancy among K-12 educators to engage with stakeholders in higher education, and said that there was “this atmosphere that he’s a professor and…I would never call a professor because I don’t want to bother them; they have important things to do” (Nick Browning). In spite of the acknowledgement of institutional culture barriers among groups, the K-12 stakeholders were positive about the relationships and Browning concluded by saying that the hub is “breaking down those barriers” between stakeholder groups.

Discussion: Continuous communication. Partner interviews indicated that communication within the hub is targeted and purposeful. Relationships between partners were largely facilitated by ESCP staff members, and K-12 educator comments regarding difficulties in
partnering across sectors pointed to the value of this relationship-brokering role. In particular, educators in the hub may feel ill prepared to engage business partners on their own. This finding highlights the value of the partnering component of the STEM Fellows program. Educators participating in this program forged business relationships as part of the program, and this experience may provide teachers with the confidence to incorporate such collaborative programs into their classrooms. Although there were a limited number of STEM Fellows, modeling business sector engagement may be a way that the Fellows can provide professional development to their peers at the school level. Additionally, business engagement strategies could be a useful component of the hub’s more general professional development activities in the future, especially if staffing changes affects the hub’s capacity to act in the relationship-brokering role.

**Backbone Support.** Intermediary, or backbone, leadership is the linchpin of collective impact organizations. The presence of staff and infrastructure dedicated to coordinating partner organizations and promoting each of the other four tenets of collective impact (Turner et al., 2012) are critical to these organizations’ abilities to effect social change. Indeed, the backbone organization is responsible for guiding the formation of the common agenda, establishing shared measurement systems, coordinating partnership activities, and facilitating continuous communication. Kania and Kramer (2013) contended that the backbone organization should have staff and a specific set of skills oriented toward coordinating partner activities and to provide infrastructure to support the initiative. Furthermore, mobilizing funding to support the partnership’s activities and ensure the backbone organization’s continued existence (Hanley Brown et al., 2012) is a key role for the backbone organization. This task is complicated by collective impact organizations’ focus on long-term outcomes and the fact that many funders
“are used to receiving credit for supporting specific short-term outcomes” (Hanley Brown et al., 2012, p. 6) rather than participating in gradual, systemic change.

The RFE acted as a parent organization for the STEM Hub, providing a home for the hub leadership and an administrative support infrastructure critical to the hub’s work. The relationship between the STEM hub and the RFE was described as a mutual one, however. Sheila Woodford pointed out that the hub has “more than administrative support” from the RFE, and that their work is “integral” to the RFE’s work to support K-12 education in the region as well. Woodford furthermore acknowledged the value of situating the hub outside of the K-12 school system, saying that this allows hub staff to “be more frank and talk about the challenges teachers are facing” without the conversation being personalized to a school or district staffing structure. Karen Banks also acknowledged the value of functioning outside of the K-12 system and reflected on one of the benefits of her background in business as the ability to “push back” and ask “is there a way that we could have business input into this?”

Partners conceptualized the hub as a connecting agency, and interviews also yielded insights into the value of the hub’s location within the RFE. The value of individual personalities and backgrounds was also an important theme that emerged from interview data. The following sections will discuss these phenomena as well as partner perspectives on hub sustainability.

**Hub as a connector.** All stakeholders interviewed indicated that the hub played an important role in connecting various stakeholder groups and partners. Colin Taylor reflected the business community perspective when he said, “they’ve done a really good job in establishing some strong relationships.” Roger Potts described the hub’s role as a “catalyst” in relationship formation, providing the opportunity for new relationships but not micro-managing those
relationships, and added that “they put people together. And so there are...connections that have happened as a consequence of the hub that the hub probably is not going to know anything about.” Laura Smithson particularly mentioned the importance of the hub in connecting school systems within the region with one another, a sentiment that Roger Potts echoed when he reflected upon the “community of practice” for STEM education that has evolved regionally via professional development activities.

Hub staff’s skill in networking may provide an incentive for partners to maintain their involvement in the hub. David Marsh reflected that “the hub is really going to connect themselves to the stars...they’re identifying the right people to have on the bus, which is very, very important.” He went on to provide an example of how the hub’s connectedness across stakeholder groups could benefit individual partners. In applying for grant funds for his organization, he was able to contact hub staff to identify the appropriate contact at a local bank to request a letter of support, noting that this connection streamlined the process for him significantly.

**RFE as parent organization.** All partners indicated that the hub’s location within the RFE was preferable to situating its leadership within the K-12 school system. Interestingly, both post-secondary partners indicated that the RFE provided a “neutral ground” (Charles Stafford) or “neutral zone” (Laura Smithson) for leadership. Nick Browning reflected that the RFE provided a space for the hub that is free from school district “politicking.” Roger Potts added that it was useful for the hub to be a “part of a slightly larger organization that’s integrated into the whole fabric” of the community. Mike Lewellen felt that, from a business perspective, housing the hub outside of a K-12 institution was crucial. Colin Taylor added to the business stakeholder perspective, saying that he appreciated the clear focus of the hub’s leadership and suspected that
had its leadership been placed within K-12 it may have been less successful due to competition for resources.

A K-12 partner and a community organization partner both reflected on the potential effects of situating leadership within a higher education institution. Nick Browning felt that this type of leadership would be a disincentive to educator involvement. When he spoke about educator “apprehension” in engaging higher education partners, he added “if we put this kind of hub at a postsecondary institution – the tendency would be for K-12 educators to avoid it.” Victor Housman also objected to post-secondary leadership, but referenced financial issues, saying that universities “take their cut, which is…usually very big. You know, most of it goes to overhead…there’s more of a focus on what the university needs.”

Additionally, partners noted that the RFE provided immediate credibility to the hub because of its long-standing role in the community. Mike Lewellen referred to the value of leading via an organization “who has been in the trenches” of education for an extended period of time and added that the RFE “has the trust of the business community.” Roger Potts commented on the value of the RFE’s credibility in the community as a possible incentive for partner participation when acknowledged the usefulness of a “public admission or effort…at the head of all the organizations…everybody else sees that okay, they’ve bought in.” He added that the RFE’s history of working with, but independently from, the educational system gives it credibility as a leader in the STEM reform effort.

Administrative support and staffing capabilities were also perceived as benefits of placing hub leadership within the RFE. Nick Browning and Laura Smithson both commented that the RFE’s role as a fiscal and fundraising agency is important to the hub’s future, a phenomenon that will be examined more thoroughly in the sustainability discussion to follow.
Charles Stafford added that the dedicated staff at the hub has been key to its success, and noted that if leadership was shared between partner organizations, hub duties would be an addition to a “day job” and “we know from experience that doesn’t work.” Laura Smithson added that having a person who is “accountable” for the work is key to the hub’s success.

**Individual personalities and backgrounds.** While the structure of the hub is admittedly important, the individuals staffing that structure were recognized to be crucial to the hub’s success as well. Victor Houseman referred to this as a marriage of structure and personal traits. He began by stating that Banks and Woodford “do a fantastic job” and added that “you know, structure is important and I think the structure is a good structure, but people are just as important” (Victor Houseman). Charles Stafford concurred with this perspective when he said of the location of the hub “I don’t think it matters as much as the people…that are doing the work” and added that Banks “is the hub.” Several stakeholders echoed the value of personal traits in staff members, saying of Banks, “she was the primary reason why the hub here was successful from day one,” and that she “is the glue that holds us all together” (Mike Lewellen). From the educator’s perspective, Roger Potts called Woodford “superb – a superb educator. And she has the motivation and interpersonal skills and temperament to – to engage people.” Potts added, “I wouldn’t minimize the impact of the quality of the two people involved.” Participants commented upon hub staff’s openness to input and various perspectives (David Marsh, Laura Smithson, Charles Stafford), willingness to act as connectors and engage with the community (Mike Lewellen, Charles Stafford, Laura Smithson) and passion and enthusiasm for the work they do (David Marsh).

Mike Lewellen and both K-12 educators interviewed expressed the value of Banks’ background in business. They felt that her background in the business community lent her
credibility with business stakeholders (Mike Lewellen) and allowed her to communicate the
business perspective to educators effectively (Nick Browning). Roger Potts spoke to Banks’ and
Woodford’s ability to negotiate the space between the business and K-12 worlds saying that they
have “enough of a history with the educational system to work pretty smoothly but still be
independent from it.”

_Sustainability._ Nearly all partners acknowledged that identifying new sources of funding
would be key to sustaining the hub’s work. Victor Houseman summed up participants’ views
when he said that fundraising is necessary “if [the hub] is going to be sustainable within this
community.” The RFE was perceived to play a key role in fundraising, especially given its
existing infrastructure for development (Victor Houseman, Roger Potts, Colin Taylor). One
post-secondary stakeholder indicated that the hub incorporated sustainability strategies from its
inception, saying of the grant funding, “they’re not relying on that money…part of their strategy
has been to – from the very beginning – make those contacts with agencies and organizations
that can assist them…to make it sustainable” (Laura Smithson). Several stakeholders pointed out
the importance of having staff dedicated to hub work in the long term (Nick Browning, Mike
Lewellen, Victor Houseman, Roger Potts, Charles Stafford) in order to keep the hub’s
momentum going, and Charles Stafford stated that “without the people whose job it is to do that
[run the hub] - it doesn’t work.”

Two stakeholders foresaw a future in which the hub would no longer be necessary.
Instead, these individuals envisioned a self-sustaining network of STEM Fellows and business
people (Nick Browning, Colin Taylor). This was not conceptualized as a short-term goal,
however, since both acknowledged that there would have to be sufficient capacity in place before
the formal hub structure could dissolve. Although Taylor did not provide a timeframe, Browning identified this time period specifically as five to ten years.

A business partner and a community group partner expressed concern about public understanding of the hub’s work as a potential challenge to sustainability (Victor Houseman, Mike Lewellen). These individuals perceived that the general public is confused about the difference between the hub and the STEM school. Lewellen pointed out that, while the school is a tangible entity whose work is easy to understand, “the community doesn’t have a great understanding of what the hub does, [and] it makes it harder to get the money to make it sustainable” and described the hub as “nebulous” to the public. Lewellen concluded by saying that “we have a sales job to do” to portray the hub’s work to the public and funding agencies in order to leverage funds to sustain the hub’s infrastructure.

**Discussion: Backbone support.** The leadership and administrative support that the hub staff provides was clearly perceived to be a crucial factor in the ESCP’s achievements to date. Furthermore, the RFE’s neutral location between stakeholder groups provided the hub with flexibility and credibility in carrying out its work. The RFE’s existing fund-raising infrastructure and capacity for long-range planning were also perceived to be crucial to the hub’s ongoing existence. The tendency to identify the hub with specific individuals in staff positions is cause for some concern regarding the hub’s future, since, at the time of this study, Banks announced her intention to resign from her position. Given the importance partners expressed about the value of individuals combined with the value of the structure, the partnership will need to identify carefully the individual characteristics they seek when making staffing decisions in the future.
Conclusion, research question 2. The ESCP attended to some extent to each of the five conditions of collective impact. There have been clear attempts through the hub’s inception process and public relations efforts to communicate the hub’s mission and vision widely in the interest of creating a shared understanding. Although not all partners interviewed were able to articulate the three priorities that hub staff identified – informing the public, engaging partners, and providing professional development for educators – most touched on all three priorities at some point in their interviews. Although a larger vision for the hub’s work was somewhat more elusive in interview data, most partners indicated that the vision involved some sort of institutionalization of STEM understanding in the community.

Of the five collective impact conditions, the hub has made the least progress with establishing shared measurement systems. The uncertainty about what and how to measure, combined with uncertainty about future staff roles, makes it seem unlikely that such complex long-term measurement system will be devised in the near future, leaving the hub to rely on more developmental measures such as participation rates.

ESCP partners’ activities and communication within the hub are largely initiated and coordinated by hub staff that operate on a strategic, needs-based engagement system. This highlights the reliance of the hub upon staff, and particularly upon the personal characteristics of Banks and Woodford who have developed a great deal of credibility with various stakeholder groups. Because of this reliance, sustainability of the hub is crucial at this point. Staffing decisions and fund-raising activities are crucial to the hub maintaining its momentum in the work of regional STEM education reform.

In sum, the hub’s infrastructure at the time of this study was still in the formative stage and was highly dependent upon hub staff and upon the individuals in those positions. While
there was evidence of increasing cross-sector connections for STEM programs and cross-fertilization of knowledge bases, changing funding streams may make the hub’s work more programmatically oriented, and it is not at all certain that programs such as teacher job shadowing will continue without staffing and funding. Although the institutional mindset of the importance of STEM education seemed to be gaining ground throughout the region, continued strong leadership and relationship brokering will be necessary to maintain and grow this phenomenon.

Research Question 3

The third research question, *What is the level of collaboration in the partnership?*, represents the quantitative portion of this mixed methods study. The following section will present survey findings for the partnership as a whole and for individual stakeholder groups in order to highlight convergences or divergences between groups.

**Wilder Collaboration Factors Inventory findings.** Table 7 summarizes responses by collaboration factor and collective impact theme for all respondents. Level of Collaboration (LOC) is presented according to Townsend and Shelley’s (2008) recommended scoring system: strong (≥ 4.0); approaching strength (3.5 – 3.9); approaching concern (3.0 – 3.4) and concern (≤ 2.9). The right-hand column of Table 7 provides LOC scores for collective impact themes by averaging all items for the factors associated with that theme. Common agenda was an area of strong collaboration while the other four collective impact themes had means that placed them into the approaching strength LOC.
Table 7.

Survey responses by collaboration factor and collective impact theme.

<table>
<thead>
<tr>
<th>Collective Impact (C.I.) Theme</th>
<th>Related Collaboration Factor</th>
<th>Survey Question #s</th>
<th>Factor Mean, Standard Deviation</th>
<th>Level of Collaboration (LOC) by factor</th>
<th>Mean and Standard Deviation by C.I. theme</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Agenda</td>
<td>History of collaboration in the community</td>
<td>1,2</td>
<td>M = 3.85 s = .94</td>
<td>Approaching strength</td>
<td>M_{CA} = 4.11 s_{CA} = .85</td>
</tr>
<tr>
<td>Common Agenda</td>
<td>Favorable political and social climate</td>
<td>5,6</td>
<td>M = 4.44 s = .72</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Common Agenda</td>
<td>Appropriate cross-section of members</td>
<td>9, 10 (n=26 for Q10)</td>
<td>M = 3.58 s = .95</td>
<td>Approaching strength</td>
<td></td>
</tr>
<tr>
<td>Common Agenda</td>
<td>Concrete, attainable goals and objectives</td>
<td>31, 32, 33 (n=25)</td>
<td>M = 4.15 s = .75</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Common Agenda</td>
<td>Shared vision</td>
<td>34, 35 (n=24)</td>
<td>M = 4.23 s = .69</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Common Agenda</td>
<td>Unique purpose</td>
<td>36, 37 (n=24)</td>
<td>M = 4.42 s = .74</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Shared Measurement</td>
<td>Appropriate pace of development</td>
<td>24, 25 (n=25)</td>
<td>M = 3.74 s = .80</td>
<td>Approaching Strength</td>
<td>M_{SM} = 3.74 s_{SM} = .80</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Members see collaboration as in self-interest</td>
<td>11</td>
<td>M = 4.52 s = .64</td>
<td>Strong</td>
<td>M_{MRA} = 3.79 s_{MRA} = .93</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Ability to compromise</td>
<td>12</td>
<td>M = 3.54 s = .95</td>
<td>Approaching Strength</td>
<td></td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Members share stake in process and outcome</td>
<td>13, 14, 15 (n=25 for Q15)</td>
<td>M = 3.92 s = .83</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Multiple layers of participation</td>
<td>16, 17 (n=26)</td>
<td>M = 3.25 s = 1.05</td>
<td>Approaching concern</td>
<td></td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Flexibility</td>
<td>18, 19 (n=26)</td>
<td>M = 4.04 s = .86</td>
<td>Strong</td>
<td></td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>Development of clear policy roles and guidelines</td>
<td>20, 21 (n=26)</td>
<td>M = 3.62 s = .80</td>
<td>Approaching Strength</td>
<td></td>
</tr>
</tbody>
</table>

Note: all sample sizes are n=27 unless otherwise indicated

(continued)
An examination of the twenty factors individually also yields relatively high collaboration scores, with eighteen of the twenty factors falling into the strong or approaching strength categories. Four factors, *favorable political and social climate*, *unique purpose*, *members see collaboration as in self-interest*, and *skilled leadership*, were particular strengths, with LOC scores falling into the strong category. Partners ranked two factors, *multiple layers of participation* and *sufficient funds, staff, materials, and time*, in the bottom half of the LOC scale, with combined means of less than 3.5 for the constituent items.

One factor, *multiple layers of participation*, fell into the approaching concern group with $M = 3.25$. It is notable, however, that this factor had a relatively high standard deviation of 1.05. This factor is comprised of two survey items, and I examined the items individually since a large standard deviation in only one of the items might have skewed results for the factor. The
standard deviations for the survey items comprising this factor are very similar, however, and are presented individually in Table 8. Because of the large standard deviations, the factor as a whole was examined by stakeholder groups. The standard deviations within the groups were substantially smaller than for the group as a whole, and the LOC for the factor varies between each group with community group/non-profit and post-secondary group responses falling into the concern category while K-12 respondents ranked this factor as approaching strength and the one business respondent’s answers indicated that this factor is a strong one for the ESCP.

Table 8.

*Response Summary for Multiple Layers of Participation Factor.*

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>N</th>
<th>Mean and Standard Deviation Overall</th>
<th>Mean and Standard Deviation by stakeholder group</th>
</tr>
</thead>
<tbody>
<tr>
<td>16.-When the ESCP makes major decisions, there is always enough time for members to take information back to their organizations to confer with colleagues about what the decision should be.</td>
<td>26</td>
<td>$M = 3.19$ $s = 1.059$</td>
<td>$M_{K-12} = 3.86$ $s_{K-12} = .89$</td>
</tr>
<tr>
<td>17.-Each of the people who participate in decisions in the ESCP can speak for the entire organization they represent, not just a part.</td>
<td>26</td>
<td>$M = 3.31$ $s = 1.050$</td>
<td>$M_{Post-sec} = 2.83$ $s_{Post-sec} = .83$ $M_{Bus} = 4.50$ $s_{Bus} = N.A.$</td>
</tr>
</tbody>
</table>

Mattesich et al. (2001) described this factor as an indication that all organizational levels within partner organizations have representation and involvement in the partnership. The low ratings by post-secondary institutions and community group/non-profit organizations could be due to institutional culture factors such as the nature of hierarchical relationships between organizational levels, but could also indicate that individuals in these groups feel less engaged in
the partnership than do K-12 education stakeholders.

The one collaboration factor that respondents ranked in the concern category was *sufficient funds, staff, materials, and time*. Given the fact that the ESCP was coming to the end of its initial grant funding and faced the loss of a key staff member at the time of this study, it was not particularly surprising that stakeholders would perceive this as an area of concern. The means for each of the items in this factor are correspondingly low as displayed in Table 9 and the means for each stakeholder group fall into the concern or approaching concern category.

Table 9.

*Response Summary for Sufficient Funds, Staff, Materials, and Time Factor.*

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Mean and Standard Deviation by Stakeholder Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>38.-The ESCP has adequate funds to do what it wants to accomplish.</td>
<td>24</td>
<td>2.38</td>
<td>.824</td>
<td>MNK-12 = 2.45&lt;br/&gt;MNK-12 = .69</td>
</tr>
<tr>
<td>39.-The ESCP as adequate &quot;people power&quot; to do what it wants to accomplish.</td>
<td>24</td>
<td>2.92</td>
<td>.929</td>
<td>MNPost-sec = 2.67&lt;br/&gt;MNPost-sec = 1.15</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MMBus = 2.00&lt;br/&gt;MBus = N.A.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>MCommunity = 3.00&lt;br/&gt;MCommunity = .961</td>
</tr>
</tbody>
</table>

Although small sample sizes and grouping of items into factors prohibited inferential statistics to compare stakeholder groups, the sort of group differences displayed in the *multiple layers of participation* factor may have significance for the ESCP’s work and for further research. Graphic representations of stakeholder group responses for individual factors are provided in Figures 5-9, illustrating convergences and divergences in stakeholder group reports.
of LOC. The means and standard deviations for all the groups of factors related to each
collective impact theme are presented in Table 10., and means and standard deviations for each
group are provided in Table 11. It should be noted that the LOC presented for the business
group represents the response of only one stakeholder and therefore lacks any generalizability to
this stakeholder group as a whole. Although this participant’s responses are included in the
visual representation of responses, they will not contribute substantively to the discussion of
stakeholder group response variations because of the extremely small sample size.

![Common Agenda Collaboration Factors](image)

LOC >4.0 = Strong
LOC 3.5 – 3.9 = Approaching Strength
LOC 3.0 – 3.4 = Approaching Concern
LOC < 2.9 = Concern

*Figure 5.* Stakeholder LOC responses for collaboration factors associated with common agenda.
LOC > 4.0 = Strong
LOC 3.5 – 3.9 = Approaching Strength
LOC 3.0 – 3.4 = Approaching Concern
LOC < 2.9 = Concern

*Figure 6.* Stakeholder LOC responses for collaboration factor associated with shared measurement.
Figure 7. Stakeholder LOC responses for collaboration factors associated with mutually reinforcing activities.
LOC >4.0 = Strong
LOC 3.5 – 3.9 = Approaching Strength
LOC 3.0 – 3.4 = Approaching Concern
LOC < 2.9 = Concern

Figure 8. Stakeholder LOC responses for collaboration factors associated with continuous communication.
LOC > 4.0 = Strong
LOC 3.5 – 3.9 = Approaching Strength
LOC 3.0 – 3.4 = Approaching Concern
LOC < 2.9 = Concern

Figure 9. Stakeholder LOC responses for collaboration factors associated with backbone support.
Table 10.

*Stakeholder Group Data for Collective Impact Themes.*

<table>
<thead>
<tr>
<th>Collective Impact Theme</th>
<th>K-12</th>
<th>Post-secondary</th>
<th>Business</th>
<th>Community Group/Non-profit Organization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>MCA</td>
<td>sCA</td>
<td>LOC:</td>
<td>MCA</td>
</tr>
<tr>
<td>Common Agenda</td>
<td>3.92</td>
<td>.78</td>
<td>Strong</td>
<td>4.26</td>
</tr>
<tr>
<td>Shared Measurement</td>
<td>4.05</td>
<td>.65</td>
<td>Strong</td>
<td>3.67</td>
</tr>
<tr>
<td>Continuous Communication</td>
<td>4.16</td>
<td>.90</td>
<td>Strong</td>
<td>3.73</td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>3.97</td>
<td>.80</td>
<td>Approaching strength</td>
<td>3.74</td>
</tr>
<tr>
<td>Backbone Support</td>
<td>3.55</td>
<td>.96</td>
<td>Approaching Strength</td>
<td>3.69</td>
</tr>
</tbody>
</table>
Table 11.

**Stakeholder Group Survey Data for Collaboration Factors.**

<table>
<thead>
<tr>
<th>Collaboration Factor (related Collective Impact theme)</th>
<th>Item #s</th>
<th>K-12</th>
<th>Post-Secondary</th>
<th>Business</th>
<th>Community Group/Non-profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of collaboration in the community (Common Agenda)</td>
<td>1, 2</td>
<td>M = 3.45 s = .74 LOC: Approaching strength</td>
<td>M = 4.0 s 1.13 LOC: Strong</td>
<td>M = 4.5 s = N.A. LOC: Strong</td>
<td>M = 4.17 s = .92 LOC: Strong</td>
</tr>
<tr>
<td>Collaborative group seen as a legitimate leader in the community (Backbone Support)</td>
<td>3, 4</td>
<td>M = 3.95 s = .38 LOC: Strong</td>
<td>M = 4.17 s = .58 LOC: Strong</td>
<td>M = 4.0 s = N.A. LOC: Strong</td>
<td>M = 3.78 S = .65 LOC: Approaching strength</td>
</tr>
<tr>
<td>Favorable political and social climate (Common Agenda)</td>
<td>5, 6</td>
<td>M = 4.50 s = .51 LOC: Strong</td>
<td>M = 4.75 s = .45 LOC: Strong</td>
<td>M = 5.0 s = N.A. LOC: Strong</td>
<td>M = 4.10 s = .96 LOC: Strong</td>
</tr>
<tr>
<td>Mutual respect, understanding, and trust (Continuous Communication)</td>
<td>7, 8</td>
<td>M = 4.41 s = .73 LOC: Strong</td>
<td>M = 4.10 s = .83 LOC: Strong</td>
<td>M = 4.0 s = N.A. LOC: Strong</td>
<td>M = 3.78 S = 1.22 LOC: Approaching strength</td>
</tr>
<tr>
<td>Appropriate cross-section of members (Common Agenda)</td>
<td>9, 10</td>
<td>M = 3.57 s = .87 LOC: Approaching strength</td>
<td>M = 4.75 S = .45 LOC: Strong</td>
<td>M = 5.0 s = N.A. LOC: Strong</td>
<td>M = 3.39 s = 1.14 LOC: Approaching concern</td>
</tr>
<tr>
<td>Members see participation as in their own interest (Mutually Reinforcing Activities)</td>
<td>11</td>
<td>M = 4.64 s = .50 LOC: Strong</td>
<td>M = 4.33 s = .82 LOC: Strong</td>
<td>M = 4.0 s = N.A. LOC: Strong</td>
<td>M = 4.56 s = .73 LOC: Strong</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Collaboration Factor (related Collective Impact theme)</th>
<th>Item #s</th>
<th>K-12</th>
<th>Post-Secondary</th>
<th>Business</th>
<th>Community Group/Non-profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to compromise (Mutually Reinforcing Activities)</td>
<td>12</td>
<td>M = 3.63 s = .50 LOC: Approaching strength</td>
<td>M = 4.33 s = .82 LOC: Strong</td>
<td>M = 4.0 s = N.A. LOC: Strong</td>
<td>M = 3.33 s = 1.22 LOC: Approaching concern</td>
</tr>
<tr>
<td>Members share a stake in both process and outcome (Mutually Reinforcing Activities)</td>
<td>13, 14, 15</td>
<td>M = 4.06 s = .72 LOC: Strong</td>
<td>M = 3.89 s = .76 LOC: Approaching strength</td>
<td>M = 4.33 s = N.A. LOC: Strong</td>
<td>M = 3.70 s = .95 LOC: Approaching strength</td>
</tr>
<tr>
<td>Multiple layers of participation (Mutually Reinforcing Activities)</td>
<td>16, 17</td>
<td>M = 3.86 S = .89 LOC: Approaching strength</td>
<td>M = 2.83 S = .83 LOC: Concern</td>
<td>M = 4.5 s = N.A. LOC: Strong</td>
<td>M = 2.56 S = .95 LOC: Concern</td>
</tr>
<tr>
<td>Flexibility (Mutually Reinforcing Activities)</td>
<td>18, 19</td>
<td>M = 4.14 s = .77 LOC: Strong</td>
<td>M = 3.92 s = .67 LOC: Approaching strength</td>
<td>M = 5.0 s = N.A. LOC: Strong</td>
<td>M = 2.88 s = 1.10 LOC: Concern</td>
</tr>
<tr>
<td>Development of clear policy roles and guidelines (Mutually Reinforcing Activities)</td>
<td>20, 21</td>
<td>M = 3.73 s = .70 LOC: Approaching strength</td>
<td>M = 3.75 s = .62 LOC: Approaching strength</td>
<td>M = 4.0 s = N.A. LOC: Strong</td>
<td>M = 3.31 s = 1.01 LOC: Approaching strength</td>
</tr>
<tr>
<td>Adaptability (Backbone Support)</td>
<td>22, 23</td>
<td>M = 3.86 s = .79 LOC: Approaching strength</td>
<td>M = 3.83 s = .83 LOC: Approaching strength</td>
<td>M = 3.5 s = .83 LOC: Approaching strength</td>
<td>M = 3.64 s = .84 LOC: Approaching strength</td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Collaboration Factor (related Collective Impact theme)</th>
<th>Item #s</th>
<th>K-12</th>
<th>Post-Secondary</th>
<th>Business</th>
<th>Community Group/Non-profit</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Appropriate pace of development</strong> (Shared Measurement)</td>
<td>24, 25</td>
<td>M = 4.05 s = .65 LOC: Strong</td>
<td>M = 3.67 s = .78 LOC: Approaching strength</td>
<td>M = 3.5 s = N.A. LOC: Approaching strength</td>
<td>M = 3.36 s = .93 LOC: Approaching concern</td>
</tr>
<tr>
<td><strong>Open and frequent communication</strong> (Continuous Communication)</td>
<td>26, 27, 28</td>
<td>M = 4.03 s = .98 LOC: Strong</td>
<td>M = 3.61 s = .85 LOC: Approaching strength</td>
<td>M = 3.33 s = N.A. LOC: Approaching concern</td>
<td>M = 3.71 s = 1.27 LOC: Approaching strength</td>
</tr>
<tr>
<td><strong>Established informal relationships and communication links</strong> (Continuous Communication)</td>
<td>29, 30</td>
<td>M = 4.09 s = .92 LOC: Strong</td>
<td>M = 3.58 s = .79 LOC: Approaching strength</td>
<td>M = 2.5 s = N.A. LOC: Concern</td>
<td>M = 4.21 s = 1.05 LOC: Strong</td>
</tr>
<tr>
<td><strong>Concrete, attainable goals and objectives</strong> (Common Agenda)</td>
<td>31, 32, 33</td>
<td>M = 4.12 s = .65 LOC: Strong</td>
<td>M = 4.17 s = .51 LOC: Strong</td>
<td>M = 4.67 s = N.A. LOC: Strong</td>
<td>M = 4.10 s = 4.04 LOC: Strong</td>
</tr>
<tr>
<td><strong>Shared vision</strong> (Common Agenda)</td>
<td>34, 35</td>
<td>M = 4.3 s = .66 LOC: Strong</td>
<td>M = 4.17 s = .58 LOC: Strong</td>
<td>M = 4.50 s = N.A. LOC: Strong</td>
<td>M = 4.14 s = .86 LOC: Strong</td>
</tr>
<tr>
<td><strong>Unique purpose</strong> (Common Agenda)</td>
<td>36, 37</td>
<td>M = 4.4 s = .68 LOC: Strong</td>
<td>M = 4.5 s = .52 LOC: Strong</td>
<td>M = 4.0 s = N.A. LOC: Strong</td>
<td>M = 4.43 s = .94 LOC: Strong</td>
</tr>
<tr>
<td><strong>Sufficient funds, staff, materials, and time</strong> (Backbone Support)</td>
<td>38, 39</td>
<td>M = 2.45 s = .69 LOC: Concern</td>
<td>M = 2.67 s = 1.15 LOC: Concern</td>
<td>M = 2.0 s = N.A. LOC: Concern</td>
<td>M = 3.0 s = .96 LOC: Approaching concern</td>
</tr>
<tr>
<td><strong>Skilled leadership</strong> (Backbone Support)</td>
<td>40</td>
<td>M = 4.2 s = .92 LOC: Strong</td>
<td>M = 4.5 s = .55 LOC: Strong</td>
<td>M = 5.0 s = N.A. LOC: Strong</td>
<td>M = 4.3 s = 1.1 LOC: Strong</td>
</tr>
</tbody>
</table>
The varying samples sizes across participant groups prevent the presentation of any inferential statistics and represent a significant limitation to the survey’s generalizability across the partnership. It is important to note, however, that Mattesich et al. (2001) contended that the survey instrument was not intended to “act as a guide to specific actions” (p. 5) but is rather intended to focus attention on the importance of each collaboration factor in order to assess areas of strength and weakness so that collaborative partners may identify areas in which change may be needed.

The two factors discussed above, *multiple layers of participation* and *sufficient funds, staff, materials, and time* were the only factors that two or more stakeholder groups identified as areas of concern for the ESCP. Table 10 shows that stakeholders consistently found overall progress in collective impact characteristics to be strong or approaching strong, with only the community group/non-profit organization respondents ranking the shared measurement factor as an area approaching concern.

Overall, the community group/non-profit organization stakeholder group was more likely than other groups to return responses that fell in the approaching concern and concern categories. The following LOCs for this group fell into the lower half of the LOC scale: *ability to compromise, multiple layers of participation, and flexibility* (mutually reinforcing activities theme); *appropriate pace of development* (shared measurement theme); and *sufficient funds, staff, materials, and time* (backbone support theme). On the other hand, K-12 education stakeholders ranked all factors as strong or approaching strength with the exception of the *sufficient funds, staff, materials, and time* factor as discussed above. Post-secondary participant responses to the *multiple layers of participation* factor fell into the concern category although all other factors scored in the strong or approaching strength categories for this stakeholder group.
Scale reliability. While there is evidence of scale validity for the Wilder Collaboration Factors survey (Townsend & Shelley, 2008), the survey developers encouraged further research-based contributions to survey validity and ways of using the instrument with collaborative initiatives (Mattesich et al., 2001). Cronbach’s alpha is used to assess the internal consistency of the survey for factors comprised of more than one survey item and also for the factor groupings correlated to collective impact themes. Recommended minimum sample sizes for reliability studies using Cronbach’s alpha vary (Bonnett, 2002), however, Fleiss (1986) suggested that sample sizes as small as 15-20 are sufficient. Although the sample size of 27 may limit the power of the analysis, it exceeds Fleiss’ minimum requirements and will therefore be deemed acceptable for the purposes of this study. Tavokol and Dennick (2011) reported that alpha values higher than .70 indicate internal consistency for a scale, and this threshold will be used for the purposes of this study.

Table 12 presents the scale reliability scores for seventeen of the twenty Wilder Collaboration factors. Three of the factors, members see collaboration as in their self-interest, ability to compromise, and skilled leadership, each contain only one item and therefore alpha scores could not be calculated for these items. These one-item constructs may present a reliability threat to the survey since it is impossible to assess internal consistency and are inherently unreliable as a result (Gliem & Gliem, 2003).
Table 12.

Wilder Collaboration Factor Inventory Reliability by Collaboration Factors

<table>
<thead>
<tr>
<th>Collaboration Factor</th>
<th>Number of Items</th>
<th>Sample Size*</th>
<th>Cronbach’s Alpha Reliability Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>History of collaboration</td>
<td>2</td>
<td>27</td>
<td>.92</td>
</tr>
<tr>
<td>Collaborative group seen as a legitimate leader in the community</td>
<td>2</td>
<td>27</td>
<td>.43</td>
</tr>
<tr>
<td>Favorable political climate</td>
<td>2</td>
<td>27</td>
<td>.83</td>
</tr>
<tr>
<td>Mutual respect, understanding, and trust</td>
<td>2</td>
<td>26</td>
<td>.89</td>
</tr>
<tr>
<td>Appropriate cross-section of members</td>
<td>2</td>
<td>26</td>
<td>.40</td>
</tr>
<tr>
<td>Members share a stake in both process and outcome</td>
<td>3</td>
<td>26</td>
<td>.76</td>
</tr>
<tr>
<td>Multiple layers of participation</td>
<td>2</td>
<td>26</td>
<td>.74</td>
</tr>
<tr>
<td>Flexibility</td>
<td>2</td>
<td>26</td>
<td>.83</td>
</tr>
<tr>
<td>Development of clear policy roles and guidelines</td>
<td>2</td>
<td>26</td>
<td>.58</td>
</tr>
<tr>
<td>Adaptability</td>
<td>2</td>
<td>24</td>
<td>.73</td>
</tr>
<tr>
<td>Appropriate pace of development</td>
<td>2</td>
<td>25</td>
<td>.65</td>
</tr>
<tr>
<td>Open and frequent communication</td>
<td>3</td>
<td>25</td>
<td>.92</td>
</tr>
<tr>
<td>Established informal relationships and communication links</td>
<td>2</td>
<td>25</td>
<td>.92</td>
</tr>
<tr>
<td>Concrete attainable goals and objectives</td>
<td>3</td>
<td>25</td>
<td>.90</td>
</tr>
<tr>
<td>Shared vision</td>
<td>2</td>
<td>24</td>
<td>.87</td>
</tr>
<tr>
<td>Unique purpose</td>
<td>2</td>
<td>24</td>
<td>.50</td>
</tr>
<tr>
<td>Sufficient funds, staff, materials and time</td>
<td>2</td>
<td>24</td>
<td>.20</td>
</tr>
<tr>
<td><strong>Entire survey</strong></td>
<td><strong>40</strong></td>
<td><strong>20</strong></td>
<td><strong>.96</strong></td>
</tr>
</tbody>
</table>

*Listwise deletion for missing items.
Although the survey as a whole had an alpha coefficient of .96, indicating high internal consistency of items, alpha coefficients varied widely for factors, ranging from .20 to .92. The high reliability score for the survey items taken as a whole (.96) indicates that survey items reliably measure the overall construct of collaboration, however six out of the twenty factors had alpha coefficients that fell below the .70 threshold, indicating that there may be problems with one or more items included in each of these factors. Because each of these factors had only two component items, it was not possible to isolate problematic items by deleting and recalculating alpha values. The low factor scores indicate that although items within these collaboration factor groupings may be related to the construct of collaboration as a whole, they may not reliably measure the collaboration factor in question. These findings suggest the need for further qualitative validation procedures and revision for the collaboration factor items (Onwuegbuzie, Bustamente, & Nelson, 2010) followed by more extensive quantitative validation such as factor analysis to assess the dimensionality of the scale as a whole (Gliem & Gliem, 2003).

These findings suggest that grouping items into fewer, evidence-based, themes may provide additional insight into survey reliability and problematic items. Since Mattesich et al. (2001) admit that their six larger groupings of factors are not research-based, the regrouping of factors to correlate with evidence-based collective impact themes may provide such insight and suggest areas in need of item revision. Only one factor, appropriate pace of development, related to the shared measurement collective impact theme, and therefore only two items are included in this theme.

Table 13 provides reliability coefficients for factors grouped each of the five collective impact themes. When factors are grouped in this manner, alpha reliability is high for three of the five factors. Although reliability is lower than acceptable for backbone support, deleting survey
item 38, *our collaborative group has adequate funds to do what it wants to accomplish*, results in a revised alpha coefficient of .71. Eliminating item 39 as well, *our collaborative group has adequate “people power” to do what it wants to accomplish*, results in an alpha coefficient of .78. It is notable that the collaboration factor that these two items comprise, *sufficient funds, staff, materials, and time*, had an alpha coefficient of only .20, suggesting that there are problems with one or both of the items. It is possible that the internal inconsistencies lie in the fact that survey item 38 focuses on the hub’s funding while survey item 39 focuses on human resources, constructs that stakeholders may perceive to be unrelated. This issue will be discussed at further length in the next chapter.

Table 13.

*Wilder Collaboration Factor Inventory Reliability by Collective Impact Themes*

<table>
<thead>
<tr>
<th>Collective Impact Theme</th>
<th>Number of Items</th>
<th>Cronbach’s Alpha Reliability Coefficient</th>
<th>Cronbach’s Alpha if item X deleted (for alpha &lt; .70)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Common Agenda</td>
<td>13</td>
<td>.90</td>
<td></td>
</tr>
<tr>
<td>Shared Measurement</td>
<td>2</td>
<td>.65</td>
<td></td>
</tr>
<tr>
<td>Continuous Communication</td>
<td>7</td>
<td>.95</td>
<td></td>
</tr>
<tr>
<td>Mutually Reinforcing Activities</td>
<td>11</td>
<td>.88</td>
<td></td>
</tr>
</tbody>
</table>
| Backbone Support        | 7              | .58                                     | X = Q38, α = .71
|                         |                |                                         | X = Q39, α = .61
|                         |                |                                         | X = Q38, Q39, α = .78 |

Since only two items comprise the shared measurement theme, deletions were not possible and, in fact, although this factor is related to the shared measurement theme, it fails to directly measure this construct. The survey items ask partners to indicate the extent to which the partnership has undertaken the right amount of work and is able to keep up with its work. As such, these items may be related to the organization’s use of data in reporting its progress and partners’ understanding of the organization’s work load, but are not direct measurements of data.
collection and usage. Ultimately, therefore, the survey instrument did not provide reliable data regarding the shared measurement theme.

**Conclusion, research question 3.** While measures of collaboration for the ESCP fell mostly into the strength or approaching strength categories, the exceptions to this may have implications for the partnership’s future work. In particular, community group/non-profit stakeholders seem less sure of their place in the partnership and less confident in the strength of collaboration than other stakeholder groups in several factors. Interestingly, community group/non-profit survey respondents returned LOC scores of approaching concern or concern for a total of six of the forty factors. In contrast, K-12 respondents returned one score in this category, post-secondary stakeholders two, and the business respondent one response that fell in the lower half of the LOC scale. This could indicate that partners in the community group/non-profit organization sector feel less engaged in the work of the partnership and therefore perceived it less positively than other groups. Additionally, the across-the-board concern for resources within the partnership may indicate partner uncertainty regarding the ESCP’s sustainability, a phenomenon that could have implications for partner willingness to engage. The lack of responses from business group stakeholders may be due to an institutional culture of information overload, lack of time, or lack of interest. In any case, this may have implications for the ways in which ESCP staff communicate with and engage business sector partners in the future.

The Wilder Collaboration Factors Inventory displayed inconsistent alpha reliability coefficients across the factors, indicating that there may be problems with some items within this context. Grouping factors together to correlate with the five collective impact themes was useful in identifying problematic items in some areas, however the instrument lacked items for the shared measurement theme, suggesting an area for further research and item development.
**Research Question 4**

This section discusses the study’s mixed methods research question, *How do measures of the level of collaboration enhance understanding of the partnership’s efforts to create an infrastructure for change?* Because the study has a qualitative priority, the following discussion focuses on how the quantitative collaboration results lend insight into the qualitative interview findings.

Table 14 provides a visual linkage of interview findings with collaboration factor data. Focus is placed on those collaboration factors that had particularly high or low scores, along with areas in which stakeholder LOC scores diverged. These differences are noted where there is a difference of two or more LOC groupings (i.e., *strong* versus *approaching concern* or concern versus *approaching strength*). While inferential group mean comparisons would have lacked power in this case, these stakeholder group divergences may suggest areas for further investigation. Integrating these results with qualitative findings provides insights into areas of strengths and potential weaknesses in the partnership’s infrastructure. These findings will be discussed for each of the five collective impact themes in the following sections.
<table>
<thead>
<tr>
<th>Collective Impact Themes</th>
<th>Data Excerpts from Interviews</th>
<th>“Strong” Collaboration Factors (LOC ≥ 4.0)</th>
<th>“Concern” Collaboration Factors (LOC &lt; 3.0)</th>
<th>Interpretation of LOC Scores</th>
</tr>
</thead>
</table>
| Common agenda            | “people from every entity you can believe that were there to support this project...There’s really been no dissent.” (Post-secondary stakeholder) | • Favorable social and political climate (M =4.44)  
• Concrete, attainable goals and objectives (M=4.15)  
• Shared vision (M=4.23)  
• Unique purpose (M=4.42) | N.A. | Results for all factors for all stakeholder groups were in strong or approaching strength categories. |
|                          | “Is there an official mission and vision?” (community group/nonprofit stakeholder) | | | |
| Shared measurement       | “[outcomes] are complex and varied...is it worth paying somebody...just to figure out how to measure...?” (K-12 stakeholder) | N.A. | N.A. | Overall this factor had an LOC of approaching strength. |
|                          | “we take the long view in this...the ultimate measure will be – are our STEM graduates qualified to go to work?” (Business stakeholder) | | | K-12 rated this factor as strong (M = 4.05) while community group stakeholders rated it as approaching concern (M=3.36) |
|                          | “I don’t know if they’ve [hub staff] asked for specific data...but then again, I don’t know if they really measure attitudes, are attitudes changing” (community group/nonprofit organization stakeholder) | | | NOTE: The appropriate pace of development factor is related, but not equivalent to, this theme. The quantitative findings lent little understanding to this theme. |

(continued)
<table>
<thead>
<tr>
<th>Collective Impact Themes</th>
<th>Data Excerpts from Interviews</th>
<th>“Strong” Collaboration Factors (LOC &gt; 4.0)</th>
<th>“Concern” Collaboration Factors (LOC &lt; 3.0)</th>
<th>Interpretation of LOC Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mutually reinforcing activities</td>
<td>“it's a natural partnership when you have all those players, all singing off the same sheet of music” (Business stakeholder)</td>
<td>• Members see collaboration in own interest (M=4.52) • Flexibility (M = 4.04)</td>
<td>N.A.</td>
<td>The multiple layers of participation factor was an area of concern for both post-secondary (M=2.83) and community group/nonprofit (M=2.56) stakeholders, although K-12 stakeholders returned an LOC of approaching strength (M=3.86), Also, flexibility, was an area of concern for the community group/non-profit stakeholders with M=2.88.</td>
</tr>
<tr>
<td></td>
<td>[the hub] “has succeeded in enveloping a lot of those people...there would be companies who would call and say I'd like to be a part of this” (post-secondary stakeholder)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“The outlier to me is always [SUE] – where are they fitting into this” (K-12 stakeholder)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>[partner roles] “they’re defined programmatically in terms of what are the needs.” (community group/non-profit stakeholder)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>“[partners] are all customers to each other” (community group/non-profit stakeholder)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(continued)
<table>
<thead>
<tr>
<th>Collective Impact Themes</th>
<th>Data Excerpts from Interviews</th>
<th>“Strong” Collaboration Factors (LOC ≥ 4.0)</th>
<th>“Concern” Collaboration Factors (LOC &lt; 3.0)</th>
<th>Interpretation of LOC Scores</th>
</tr>
</thead>
</table>
| Continuous communication  | “I think we could do a better job on the level of communication” (business stakeholder)  
“Teachers weren’t sure that businesses would care or...that it would be worth their time to do this” (K-12 stakeholder)  
“as a whole it [communication] works. Probably a little bit more time if it was available, that would be beneficial because it would give, you know, various constituents an opportunity for a little bit of a deeper engagement” (business stakeholder)  
“you’re getting these like interwoven relationships” (K-12 stakeholder) | • Mutual respect (M=4.11) | • N.A. | All factors were rated strong or approaching strength by three of the stakeholder groups. The business stakeholder responding returned an LOC of concern for the factor Established informal relationships and communication links. |
| Backbone support          | “the hub idea is great because it actually assigns a person or a team of people to be in charge of that” (post-secondary stakeholder)  
“whether that’s going to be sustainable, I do believe it’s going to be whether they’re going to get, you know, the funding” (post-secondary stakeholder)  
[Karen] “is the glue that holds us all together” (business stakeholder) | • Skilled leadership (M=4.330) | • Sufficient funds, staff, materials, and time | All stakeholder groups returned an LOC of strong for skilled leadership. Sufficient funds, staff, materials, and time was an area of concern all of the stakeholder groups. |
**Common agenda.** Qualitative findings indicating that the ESCP inception process was a highly inclusive process addressing a community-wide problem was supported by survey results. Overall LOC scores for each of the thirteen collaboration factors related to common agenda were in the strength or approaching strength categories. Stakeholder responses for the factor *favorable political and social climate* were uniformly strong. This is a vivid illustration of the “Eastville Way,” a phenomenon that has set the stage for partnerships such as the ESCP in the community. Partner comments reflected the favorable conditions. For example, one post-secondary partner said of the ESCP’s inception, “it was almost like a perfect storm, all the focus on STEM. So when we began writing the grant…it was obvious that we had lots of different factors playing into that we could take advantage of” (Laura Smithson).

The “Eastville Way” backdrop for the partnership was also reflected in the high scores for the factor *history of collaboration in the community*. This factor included two questions regarding the history of collaborative problem solving in the community. Henry Schulson referenced Eastville’s unique culture of collaboration when he said, “the hub here seems to work better than in other places, just from what I’ve heard. And I think one reason is because there has been a history of collaboration.” Interestingly, K-12 stakeholders returned somewhat lower scores for this factor (M = 3.45) than other stakeholder groups, with an LOC that fell between *approaching strength* and *approaching concern*. This may reflect the institutional culture barriers that K-12 participants noted in interviews. In particular, Nick Browning’s acknowledgement of teacher “apprehension” in working with the business and post-secondary sectors may reflect that K-12 schools have not been as actively involved in collaborative work in the past. Likewise, Roger Potts noted that the ESCP provides opportunities for educators to collaborate across counties, which, according to Potts, was a new phenomenon. This, too, is an
indication that K-12 education stakeholders may have experienced less of a history of collaboration in the community than other stakeholder groups.

**Shared measurement.** Interview findings indicated that partners were unclear about what systems were used to track the hub’s progress in the short term, and although there were references to the importance of longitudinal data collection, participants were uncertain about how or whether this would be accomplished. While interview participants recognized the complexity of the task of measurement, they had little concrete understanding of how the hub collected or used data. In spite of this, the only factor associated with measurement, *appropriate pace of development*, fell into the approaching strength LOC (M=3.74) overall. This most likely reflects a weakness of the survey in its ability to assess measurement practices rather than confidence in the ESCP’s measurement practices, however. The two survey items associated with this factor assess the amount of work the partnership has undertaken and the partnership’s ability to keep up with and manage that work. As such, these factors are related to partners’ understanding of progress and therefore to how the partnership tracks its activities. This factor’s relationship to shared measurement is tangential in nature, suggesting that future use of this survey instrument to assess collective impact should incorporate additional items specifically related to shared measurement.

**Mutually reinforcing activities.** Interview data indicated that ESCP staff played a strong coordinating role in managing various partners’ work for maximum efficiency and that partners experienced mutual learning and cooperation within the partnership. Roger Potts’ description of the hub as a “catalyst” captures the image of the hub staff as program initiators, leveraging the competencies of partners to sustain those programs. Partner interviews suggested that the partnership runs smoothly with distinct, yet flexible partner roles, or, as David Marsh
described it, as “almost like an organic being.” This was borne out by the overall LOC of approaching strength (M = 3.79) over the six collaboration factors associated with this theme.

Five of the six factors associated with the mutually reinforcing activities theme had LOCs of strong or approaching strength while one, *multiple layers of participation*, was in the approaching concern category. Post-secondary and community group/non-profit stakeholder responses placed this factor in the concern group for these groups. The two survey items that comprise this factor focused on having sufficient time for members to take information to their parent organizations to confer and on the ability of representatives to speak for their organizations. While interviews did not yield findings regarding the appropriateness of organizational representation, one stakeholder did indicate concern with time. This business sector participant said that if “a little bit more time – if it was available, that would be beneficial because it would give, you know, various constituents an opportunity for a little bit of a deeper engagement” (Colin Taylor). Although Taylor was the only partner to specifically refer to time limitations in his interview, the lack of business sector responses to the survey may be indicative of a lack of time for engagement in the ESCP more generally among business group stakeholders.

**Continuous communication.** Interview findings indicated that partners are pleased overall with the quality of relationships and communication within the ESCP, and the LOC of approaching strength for this theme aligns with partner perspectives from interviews. Although there was some concern from a K-12 interview participant about teacher self-efficacy in relationships with other stakeholder groups, each of the three associated collaboration factor LOCs were in the strong or approaching strength category. The only area of stakeholder concern in survey data was from the one business respondent who ranked *open and frequent*
communication as an area approaching concern, and established informal relationships and communication links an area of concern. Indeed, one business sector interview participant expressed concern about communication, saying “I think we could do a better job” (Colin Taylor). Because only one stakeholder from this group responded to the survey, however, the response lacks any generalizability across the ESCP.

**Backbone support.** Interview and survey findings for this theme focused on the role of the two ESCP staff members, the hub’s location within the RFE, and sustainability of the hub as the backbone structure. Partners expressed confidence in staff members during interviews, making statements referencing the “fantastic job” (Victor Houseman) the staff does and emphasizing “the quality of the two people involved” (Roger Potts). This was reflected in the high LOC scores for the skilled leadership factor, with all stakeholder groups ranking this factor in the strong LOC category. The ESCP’s relationship with the RFE and its long history in regional education initiatives lent the ESCP credibility from its inception. This was evidenced in statements indicating that the RFE has “a lot of credibility in the business community” (Mike Lewellen), and that it provided a “neutral zone” (Laura Smithson) for the ESCP’s work in which “you lose politicking” (Nick Browning). These perspectives are supported by survey scores for the factor collaborative group seen as a legitimate leader in the community. The two survey items comprising this factor focused on community perspectives about the ESCP’s work, and partners returned scores for this factor that fell into the strong LOC category for three stakeholder groups and approaching strength for one (community group/non-profit organization).

One area of particular concern and uncertainty that emerged during interviews was the ESCP’s future as the initial funding period ends. Partners made statements such as “that’s my biggest worry right now” (Mike Lewellen) regarding the ESCP’s sustainability. Survey results
reflected this concern, and the factor *sufficient funds, staff, materials, and time* received the lowest LOC scores of any factor. K-12, post-secondary, and business stakeholders all returned scores in the concern LOC category for this factor while the community group/non-profit group ranked this as an area approaching concern.

**Conclusion, research question 4.** Merging the qualitative and quantitative findings regarding the ESCP’s progress in creating an infrastructure for change yields several insights about partner beliefs regarding the hub, partner engagement, and the use of the Wilder Collaboration Factors Inventory to measure progress using the collective impact framework.

Both interview and survey findings suggest that there was a positive public perception of the hub and a wide base of support for its work. Staff and partner perspectives about the inclusivity of the planning process were supported by high LOC scores for the common agenda theme overall and for its constituent factors. Likewise, partners’ enthusiasm for the individuals in hub staff position was borne out by uniformly high scores for the one survey item addressing the *skilled leadership* factor.

Integration of interview findings and survey results lent some insights into partner engagement and the role of institutional cultures within the partnership as well. The uncertainty expressed during interviews from community group/non-profit partners regarding issues such as mission statement and measurement may contribute to the relatively high number of factors (six) in which this group returned LOC scores of approaching concern or concern. This could indicate that partners in this group feel less engaged in the work of the partnership and therefore perceive it less positively than other groups. The fact that the two respondents who were unsure whether their organizations were partners were both from this stakeholder group points supports the idea that community group/non-profit stakeholders may have only a lower level of engagement than
stakeholders in the K-12 and post-secondary education sectors. Alternatively, some stakeholders in this group may adopt a more guarded approach toward the ESCP since, as fellow non-profits, they may find themselves competing with the ESCP for overlapping pools of resources in the community. The poor response from the business stakeholder group on the survey may indicate that this group feels less engaged in the ESCP’s work as a whole, or it may simply reflect a divergence in institutional missions between the ESCP and organizations in the business sector that resulted in an unwillingness to devote time to completing a survey regarding the ESCP’s work. It is also interesting to note that the merged data indicate a less robust perception of collaboration in the community from K-12 stakeholders than from other stakeholder groups.

Merging the two databases also lends some insight into the use of the Wilder Collaboration Factors Inventory as well. Interview findings regarding the ESCP’s measurement practices did not align well with the survey factor related most closely to the shared measurement theme. As noted above, however, the factor was related only tangentially to this theme, and therefore the instrument failed to directly measure this shared measurement theme. Additional survey items should be developed to include this theme more comprehensively if the instrument is to be useful in the realm of collective impact. Furthermore, the survey’s reliability was threatened by low Cronbach’s alpha scores for some factors, which limits its usefulness in this context and suggests a need for further validity measures for future uses of the instrument in similar contexts.

**Conclusion.** The Polymerase Chain Reaction metaphor is a useful one for the ESCP, since staff and partners alike noted the goal of region-wide capacity building and amplification of the hub’s work. Revisiting this metaphor in light of this study’s findings indicates that the ESCP has begun to show characteristics of such a chain reaction. It is important to note that
such chain reactions require an initial stimulus that must reach a threshold level before the reaction gains the momentum necessary to produce cascading effects. Within the ESCP, the hub’s work during the initial two-year phase of federal funding may be conceived as the initial stimulus in the chain reaction. What remains unanswered at the end of the federal funding phase, however, is whether the initial work of hub staff and partners has reached the admittedly ambiguous threshold level required to maintain and amplify the ESCP’s work during the coming years. Staff members’ willingness to change course when needed and to use resources strategically coupled with the Sustainability Plan are positive signs that the ESCP may reach such a threshold point.
Chapter Five: Discussion

This study sought to understand how the Eastern STEM Change Partnership (ESCP) created an infrastructure for regional change in STEM education. This was accomplished by investigating four inter-related research questions to create a holistic description of this partnership’s work, with the five characteristics of successful collective impact organizations used as a proxy for the construct of infrastructure for change. The mixed methods case study approach permitted strategic integration of a quantitative measure of collaboration with partner perspectives on the ESCP’s progress in building an infrastructure for STEM education change. By embedding a quantitative collaboration survey within a primarily qualitative case study, a holistic picture of the ESCP emerged, permitting a nuanced understanding of stakeholder group perspectives on the partnership’s progress in creating a foundation upon which lasting change can be built.

Summary of Findings

The picture that emerged of the ESCP’s work was that of partnership staff coordinating the work of a willing community in the task of building bridges between the K-12 education sector and other stakeholder groups in order to build regional capacity for STEM education. The ESCP partnership built this capacity in several ways. First, by facilitating a dialog between area employers and K-12 educators regarding workforce needs, the hub fostered workforce-relevant programming for teachers and students. Teachers and students had opportunities to collaborate with business leaders and experience workplace settings via programs such as teacher job shadowing, field trip visits to area businesses, and the STEM Student Council. The ESCP also used a strategic approach to teacher professional development that combined classroom teaching practices such as problem-based learning with networking skills to encourage teacher to forge connections with community stakeholder groups. Furthermore, a comprehensive media
campaign was used to spread the message of the importance of STEM education to the general public and to garner ongoing support for the hub and the school.

The immediate infrastructure upon which the ESCP’s work rested was an intermediary or backbone organization that recruited skilled leadership in the form of staff members with interdisciplinary backgrounds and substantial networking skills. A growing infrastructure of partner relationships independent of hub staff was in evidence, however the Managing Director and Learning Director continued to provide the primary bridges between these sectors. The ESCP was strategic in its approach to building infrastructure, leveraging limited resources flexibly for maximum impact within the hub. At the time of this study, the infrastructure was still in its formative phases and, while stakeholders envisioned a future in which a formal support structure would no longer be necessary, that vision was one for the long-term. While partners reported feeling engaged in the partnership, the type and level of engagement varied among stakeholder groups, and integrated data suggests that bridging social capital between partners was heavily moderated by ESCP staff members, and may not be sustainable staff facilitation.

The integration of qualitative and quantitative findings revealed that, during its first two years of operation, the ESCP made substantial progress in four of the five areas collective impact (common agenda, mutually reinforcing activities, continuous communication, and backbone support) while there was still much to be accomplished in establishing shared measurement systems. The level of collaboration (LOC) scores for each area of collective impact were in the strong or approaching strength category, attesting to a widespread positive perception of the hub’s work. Integrating this data with the qualitative findings revealed divergent findings for the shared measurement construct, however examination of the survey items for this construct indicated a lack of direct relationship between the constructs in the survey and the phenomenon
of shared measurement systems. Since interview participant views regarding the lack of measurement systems accorded across stakeholder groups, qualitative findings are the primary evidence used for the construct of shared measurement systems.

That the ESCP recognized a need for continued infrastructure growth was evidenced in the sustainability plan prepared in cooperation with its parent organization, the Regional Foundation for Education (RFE). With the ESCP nearly at the end of the initial “seeding” stage at the time of this study, the plan noted the need for a period of program expansion over the next two and a half years, followed by a cultivation phase, in which the work done by the ESCP would become ingrained into the region’s educational infrastructure (Sustainability Plan). Indeed, the end date of December 2020 stipulated in the sustainability plan indicates a need for the ESCP to have backbone support six years beyond the end of its initial grant funding.

A number of strengths in the ESCP’s work were noted during this study as well as some areas that may merit further attention from hub staff and partners. These will be discussed in the following sections along with implications for the ESCP and implications for similar partnership efforts and for STEM education reform more generally. Additionally, limitations to this study and areas of potential future research will be discussed.

**Infrastructure Strengths**

There was evidence of a number of strengths in the ESCP’s efforts to build a sustainable infrastructure for STEM education improvement. These strengths included the inclusive nature of the process of forming the partnership’s agenda, the synergistic combination of structure and individuals within ESCP leadership, and the strategic use of resources within the hub. The following sections will discuss each of these infrastructure strengths.
**Inclusive agenda-setting process.** The ESCP positioned itself as a community-wide effort from the start. The grant writing process incorporated a wide swathe of individuals and stakeholder groups in the community and played an important role in focusing community attention on the importance of STEM education in the region. The inclusion of such diverse groups as the Smith County School Superintendent, the Eastville Chamber of Commerce Vice President, and a group of sixth grade basketball players is an apt example of the comprehensive approach used to formulate an agenda for the ESCP. Interview findings and survey results both supported the notion that there was a broad initial base of support for the ESCP’s work that was still in evidence two years into its work. This focus on a commonly held set of objectives will be key as the partnership enters its next, non-grant-funded, phase of operation. The ability to garner continued widespread support will require the clear articulation of objectives with tangible community benefits.

Previous findings regarding the importance of a shared vision in a partnership may lend some insight into the partnership’s successes to date (Johnson, 2012; Kania & Kramer, 2011; Siegel, 2007). The ongoing broad base of support in the ESCP, coupled with stakeholder perspectives of open communication within the partnership echoed Johnson’s (2012) findings that a common vision and sense of ownership can emerge during a partnership’s work and may be beneficial to the partnership’s ability to achieve its goals. Although in this case there was a broad base of support for the hub outset, the fact that partners across the community remained enthusiastic about the hub after two years indicated that a sense of ownership in the ESCP’s work had emerged.

Furthermore, the hub’s efforts to publicize its work may provide a further benefit for partners. Siegel (2007) and Johnson (2012) both found that recognition of partner contributions
and celebration of successes were important factors in maintaining partner engagement. The ESCP’s media blitz and public relations campaign provided an ongoing means to highlight partner contributions and successes and may have helped to create a sense of ownership among partners.

Johnson (2012) also pointed to the importance of maintaining momentum in a partnership by planning for sustainability. This is a lesson that the ESCP appeared to have taken to heart, and concern for maintaining the hub’s work was a priority as evidenced by the creation of a sustainability plan designed to provide hub funding through the end of 2020. One challenge that the hub is likely to encounter, however, is the tendency for businesses to provide short-term, project-based funding with the expectation of a near term return on investment (Kania & Kramer, 2011). While the sustainability plan outlined and justified the need for ongoing funding, this is an issue of institutional culture within the business sector that may be difficult to overcome.

**Synergy of structure and individuals.** One partner used the image of marriage to describe the process of partnering within the ESCP. This image can be extended to the relationship between the organizational structure of the hub and the individuals who hold staff positions within that structure. Stakeholders were optimistic about the benefits of situating the ESCP’s leadership within the RFE. Findings indicated that the intermediary leadership structure contributed to partner perceptions of the relative neutrality of the ESCP within the political and educational landscape of the region. Additionally, the fund-raising expertise and administrative support the RFE lent the hub were perceived to be key benefits of this structure. Indeed, because of the regional focus of the hub it was impractical to base the leadership within any one of the numerous school districts that comprise the ESCP’s range. The creation of a forward looking
sustainability plan was further evidence of the infrastructure support that the RFE lends to the hub, and the availability of staff with fund-raising expertise will certainly be a benefit to the ESCP in the long-term.

The unique skill sets and diverse sectoral backgrounds that staff members brought with them to their jobs contributed to the sense of neutrality that partners noted in the ESCP’s work. Partners expressed a high level of trust and confidence in staff members’ abilities and personal attributes, and there was a pervading sense that these particular individuals are responsible for much of the hub’s success to date. Some insight into how these individuals have impacted the STEM reform movement in the Eastville region can be gained from Malcolm Gladwell (2000), who described the important role of individuals in reaching what he called a tipping point in social movements. This tipping point is a “dramatic moment” (Gladwell, 2000, p. 9) in which ideas or messages take on the characteristics of an epidemic, spreading throughout the community as would a virus. Gladwell contended that “The Law of the Few” (p. 30), in which a small number of dynamic individuals with distinct and rare skills propel a social movement forward, is a crucial component in social movements that reach epidemic proportions.

Partners indicated that such skills are in evidence in the ESCP staff, and have contributed to its success in engaging the public in efforts to reform STEM education in the region. In his Law of the Few, Gladwell (2000) identified three distinct types of individuals as highly influential in a social movement: connectors, mavens, and salespeople. A connector, according to Gladwell, is an individual with extraordinary social networking skills, who know people in a number of sectors and are able to introduce people and forge connections across those sectors and who have “a special gift for bringing the world together” (Gladwell, 2000 p. 38). Mavens act as information brokers who have special skills in accumulating and disseminating
knowledge, combining social skills and knowledge in a unique and compelling package (Gladwell, 2000). The last category of individuals Gladwell identified are salesmen, or charismatic individuals with strong negotiation skills and skills in the “subtleties of persuasion (p. 77) that engage others in their work.

Karen Banks and Sheila Woodford together embodied Gladwell’s (2000) Law of the Few. Banks exhibited strong traits as a connector. Her business community background lent her a great deal of credibility with the private sector in the Eastville region, and her wide social networks and ability to work across them created a collaborative atmosphere in the ESCP that transcended any one sector. As one business partner said, “she is the glue that holds us all together” (Mike Lewellen). Woodford, on the other hand, had the gifts of a maven, combining her educational skills with her business sector experience into a comprehensive program of outreach and professional development that was at once unique in its approach and marketable to stakeholders. Moreover, both Banks and Woodford had characteristics of Gladwell’s salesmen. Banks’ ability to “package a message” (Sheila Woodford) was impressive as evidenced by her efforts in producing a “media blitz” (Karen Banks) for STEM education. Woodford, on the other hand, exhibited her salesmen abilities in negotiating with school districts and by engaging a diverse set of school systems and informal education stakeholders in STEM-related professional development and training.

By placing these skilled individuals within an intermediary organization, the ESCP set the stage for Gladwell’s (2000) tipping point, or, what one stakeholder called “a perfect storm” (Laura Smithson) of conditions and events. The work of uniquely skilled individuals within a structure that gives them a “neutral zone” (Laura Smithson) in which to work for change.
provided a synergy which is difficult to define but which was evident in all partner interviews and in survey results that showed uniformly high levels of support for the ESCP’s leadership.

**Strategic use of resources.** Flexibility was a hallmark of the ESCP’s work. Banks and Woodford were willing to change course mid-stream when programs showed evidence of ineffectiveness and actively looked for ways to use limited resources efficiently. The staff decision to eliminate the e-newsletter based upon poor rates of message opening was one example of this willingness to shift strategies. Also, partner engagement was structured in such a way that individual partners’ competencies were leveraged for maximum impact. One example of this was the use of a local cable television partners to broadcast a public service announcement for the hub. Partners echoed the importance of this strategy, emphasizing that rather than asking for a donation or participation in a general service project, partners are asked to participate in projects that overlap with their organization’s mission. This strategy contributed to the sense of mutual benefit in the partnership.

Indeed, Austin (2000) and Seitanidi et al. (2010) pointed out that a relationship based upon a one-way transfer of resources is likely to undermine the benefactor partner’s motivation to remain engaged in the partnership. In this case, partners across sectors indicated that they found benefit for their organizations in the hub’s work. Partners’ perspectives regarding the mutual learning they experienced within the partnership and the value to employers of a STEM-capable workforce attested to the reciprocal nature of the relationships within the ESCP. These relationships were typical of Austin’s (2000) transactional or integrative partner engagement in which there is an overlap in mission among partners and personal relationships between partners and leadership.
Infrastructure Gaps

It is important to note that at the time of this study the ESCP was just two years into its work. Staff and stakeholders recognized that the task of reforming STEM education is one that requires ongoing effort and attention and an institutional mindset among partners of “we’re in it as an organization for the long haul” (Mike Lewellen). Given the long term systemic nature of the proposed reforms, the relative youth of the ESCP, and resource limitations, it is not surprising that some gaps were identified in the infrastructure for change. In particular, weak bridging social capital among some partners, lack of public understanding of the hub’s role, and lack of shared measurement systems are areas that may impact the ESCP’s work for the long term.

Bridging social capital. The concept of bridging social capital denotes the formation of networks and relationships that span institutional or sectoral differences (Edens & Gilsinan, 2005). In a cross-sector social partnership, this bridging capital is essential, since representatives from multiple social sectors must work together for a common cause that may align only tangentially with individual institutional missions. The ESCP provided a useful structure in which to bridge differences between various stakeholder groups, however it is important to note that the ESCP was itself a separate organization with its own institutional culture. While staff members had made significant strides in connecting stakeholder groups, findings indicate that some stakeholder groups may have felt less engaged with the work of the partnership, indicating a lack of bridging capital between some sectors.

Interestingly, a third of respondents from the community group/non-profit organization stakeholder group were either unsure about their organization’s status as partners in the ESCP or reported little participation in hub activities. This may indicate that members of this stakeholder
group felt somewhat less engaged in the partnership than did partners from other stakeholder groups. Additionally, the high number of collaboration factors that stakeholders from this group placed into the approaching concern or concern category along with partners’ lack of clarity about the ESCP’s mission and vision may indicate that this group was less sure about its place within the ESCP overall.

The disappointingly low response rate from business group stakeholders (n=1) may have implications for partner engagement in this sector. Indeed, of the four stakeholder groups, partners from this group had institutional missions that are largely unrelated to education. It is possible that some partners may have conceptualized their involvement in the ESCP as a form of corporate philanthropy (Edens & Gilsinan, 2005) rather than as partners engaged in enacting a common agenda. The “long haul” (Mike Lewellen) nature of the ESCP’s work coupled with the tendency for private sector partners to focus on short-term outcomes and return on investment (Hanley Brown et al., 2012) may contribute to difficulties in engaging this group in the long-term. One business stakeholder foreshadowed the poor survey response rate from this group, however, when he said, “one of the limiting factors from a business perspective is just having enough time” (Colin Taylor) for engagement in the partnership. Indeed, these institutional limitations create additional barriers for the formation of bridging social capital, and the ability to engage business stakeholders for the long term may depend on ESCP staff continuing its proactive approach in bridging the gap between business and other stakeholder groups.

The perception of some stakeholders of the four-year university’s engagement in the ESCP may indicate a lack of bridging social capital between Southern State University (SUE) and other stakeholder groups. Since business, K-12, and community group/non-profit stakeholder interview data revealed a cross-sector uncertainty about SUE’s role, it appeared that
the bridges between SUE and other stakeholders were weak. Two important factors should be noted regarding the post-secondary education stakeholder group, however. First, Woodford noted the SUE had “huge leadership changes” during the initial two years of the ESCP’s work that may have provided discontinuity in SUE’s engagement in the partnership. Also, the role of Eastville State Community College (ESCC) in the partnership was perceived to be unrelated to that of SUE in partner interviews, suggesting that perhaps the four year university and the two-year community college should be conceptualized as separate stakeholder groups in future studies.

**Differentiation of the hub’s role.** While leadership via an intermediary organization had significant benefits for the ESCP in terms of infrastructure support and neutrality of its work, this structure also created a lack of clarity among stakeholders about the hub’s role. Interview findings indicated that the general public might be unclear about the role of the ESCP hub versus the STEM school. Mike Lewellen summed up this concern when he said, “I’m not sure that there’s a great understanding in the community at large about what the hub does.” While the ESCP’s public relations campaigns were targeted at highlighting the need for STEM education and the role of the STEM school in the region, the hub itself was a silent partner in public media campaigns. This may have implications for engaging new partners who may not recognize the ESCP hub’s role in regional STEM education reform and may also have implications for engaging financial support for hub sustainability.

Although prior research provides support for the benefits of such intermediary leadership (Honig, 2004; Johnson, 2012; Kania & Kramer, 2011), the findings of this study highlight some potential difficulties with such a leadership structure. ESCP partners recognized that the intermediary leadership provided a unique and essential value to the work of STEM education
reform and acknowledged that the dedicated staffing was crucial for the ESCP’s work. It was unclear, however, whether this recognition extended beyond the most actively involved partners. Because the STEM school and the ESCP hub were created simultaneously, there were no public relations efforts that targeted the hub’s work as an effort distinct from the school. Indeed, the main public relations efforts centered on the importance of STEM education to the region. While the STEM school was a visible enactment of STEM education, the hub’s work was more nebulous and difficult to articulate to the public.

Another of Gladwell’s (2000) crucial components for effective social movements is known as the “stickiness factor” (p. 89). The “stickiness” of a message, according to Gladwell, relies on its informational content and on its packaging. He furthermore pointed out that the components of a message that make it stick are difficult to define and, in fact, the characteristics of a message that make it stick may be “counterintuitive” (Gladwell, 2000, p. 131) and may only emerge by experimentation with the presentation of the core ideas. Since the STEM school and the hub will rely on separate funding streams in the post-grant phase, the hub must make its value clear to stakeholders and unique from that of the STEM school for purposes of sustainability. In other words, the message that the hub is an entity separate from the STEM school and that it plays an important role in propelling STEM education improvements needs to stick in the community consciousness. As of the date of this study, the media campaigns had not clearly articulated the hub’s role in regional STEM education improvement. The sustainability plan did address the needs of the hub, however this plan took effect only after the end of the initial funding period and did not include a widespread media campaign. In this case, a publicity campaign targeted to differentiating and highlighting the role of the hub may serve to clarify the hub’s role and support sustainability.
**Shared measurement systems.** Kania and Kramer (2011) acknowledged the difficulties of establishing systems of shared measurement for large-scale reform efforts engaging multiple partners, and encouraged attention to both longitudinal and developmental data collection systems. While the ESCP made some efforts to collect developmental data, most data were descriptive in nature and, at the time of this study, there was no system to aggregate data from multiple partners. Staff’s attention to making strategic use of limited resources meant that the formidable and time-intensive task of formulating such a system was postponed in lieu of pursuing other projects with more immediate impact. Karen Banks specifically noted that she intended to work with RFE data analysis personnel to formulate a system of data collection in early 2014, however involvement with the Pathways to Prosperity project and a federal grant application came to the fore and the data system development work was shelved.

Besides the time and expertise required to institute a system of data collection, there appeared to be little consensus on what phenomena should be measured and how data should be collected. While the goals in the grant application provided concrete objectives that could be reached, measured, and reported to the State STEM Change Association (SSCA), the accomplishment of those goals and the end of the grant funding period left a void in guidance for data collection. In addition, shifts in future funding sources mean that the ESCP’s objectives may shift to align with funding, creating further uncertainty about types of data that can be collected in the long term.

There was concern among staff and partners regarding the use of school level data in the form of test scores, however beyond this objection, stakeholders had little insight into how to gauge the ESCP’s progress. Interview data suggested that some combination of qualitative data regarding student attitudes and outcomes and quantitative school and employer level data might
be desirable. It is likely that the ESCP’s three distinct areas of mission – teacher training, partner engagement, and informing the public about STEM – may each warrant a distinct approach to measurement in the short term and, indeed, staff collected descriptive data in each of these three areas. How to lend more depth to this descriptive data and how to track long-term change in STEM education are, however, areas that may become increasingly important to the ESCP as they seek new funding sources.

At the same time, however, it is important to note that devising a system of metrics and data collection are time and labor-intensive processes that may not be supported by funding in the future. Neumark (2005) found that partnerships without funding earmarked for evaluating activities were ineffective in data collection and analysis. Although the ESCP is able to leverage the RFE’s data management infrastructure, it is not clear that there will be sufficient funding for developing comprehensive data and analysis systems. Indeed, the sustainability plan did not include a metrics system in its short or long-term objectives.

Implications

The findings of this study have implications for the ESCP as it moves forward and for fledgling educational partnership efforts seeking organizational structures that will support long-term change in STEM education. STEM partnerships differ from other educational partnerships because of the regional workforce development goals associated with STEM reform efforts. This focus necessitates business sector partnerships that extend beyond the philanthropic level and that involve the private sector in more transactional and integrative (Austin, 2000) activities. In particular, the ESCP may benefit from considering the role of staff in the partnership, partner engagement strategies, and public relations tactics. Similar partnership efforts may benefit from using a leadership structure similar to the ESCP’s, considering the implications of broad sectoral
inclusivity upon strategic planning, and attending to the role of bridging social capital within partnerships. The findings of this study also have implications for STEM education reform in general, for the use of collective impact theory, and for the use of mixed methods in examining partnerships.

**Implications for the ESCP.** This study was conducted just before a critical juncture in the ESCP’s work. The initial grant funding was set to expire in just a few months, and the news that Karen Banks planned to resign from her position as Managing Director had just begun to circulate among partners. It is understandable, therefore, that partners would feel concern for the future of the hub. The loss of a critical staff member who played a strong connector role may undermine confidence in the hub’s ability to maintain its momentum and points to the need to use public relations to maintain partner and public confidence in the ESCP’s ability to continue its work. The strong connections and sense of dynamism that Banks brought to the hub are phenomena that should be considered in future staffing decisions and resource allocation.

Another consideration for public relations relates to the issue of policy paradox (Mitra & Hilabi, 2012). In particular, the focus on the hub’s website regarding local business needs may have led some stakeholders to perceive a localized bias in STEM education activities. Since such a bias could alienate some stakeholders, particularly parents and students who value mobility, it may be useful to the hub to emphasize the applicability of STEM skills beyond the region.

Banks and Woodford both brought cross-sector experiences and focus to ESCP leadership. Since partners valued these diverse backgrounds and the broad inclusivity of the hub, maintaining confidence that this focus will continue during organizational transition may be key to keeping partners engaged. Targeted communications that send a positive message about the
hub’s work could be crucial, and highlighting the ESCP’s proactive approach to sustainability could be beneficial to partner engagement. It is possible that a more active and visible Advisory Board role during this transition could be helpful, and would additionally signal ongoing broad-based support for the hub’s work.

The strategic partner engagement strategy appears to have served the ESCP well to date, however it may also pose challenges as funding and staffing patterns shift in the future. As these changes occur, utilizing a defined engagement strategy may prove to be more efficient. Banks referred to an initial partner engagement strategy that was role-oriented rather than staff-directed. Business partners were presented with choices of ways to participate, including contributing to curriculum planning, hosting teachers for job shadowing, hosting student field trips, or donating items to the STEM school. The partner strategy evolved away from this “menu” approach due to the ability of staff members to leverage their social capital to target and engage partners for particular projects. Limited human resources and changing funding sources may mean that staff members have less capacity to engage partners in this way, and it may be beneficial to re-introduce the menu-based approach to engagement as a meaningful supplement to staff-mediated engagement.

Partners have relied on the strong skills of staff members in providing bridges between stakeholder groups as well. Again, with staffing changes, staff will most likely not have the capacity to continue this connecting and networking function to the extent that they had during the initial, grant funded phase of the ESCP’s work. Since initial connections have been forged, it may be beneficial to either enlist the assistance of the Advisory Board to fill this role, or to target a community organization with strong networking competencies to bring stakeholder groups together on a regular basis. For instance, an area economic development association may be able
to coordinate with hub staff to convene a STEM education task force that brings together diverse stakeholder groups for conversation and networking.

In sum, the history of flexibility within the ESCP will be especially important moving forward as funding sources shift and staffing changes are implemented. While the ESCP has attended to sustainability issues from its inception, as evidenced by the formulation of the sustainability plan, it should continue to focus on maintaining a broad base of involvement and support in order to continue its momentum.

**Implications for educational partnerships.** There are several messages for fledgling educational partnerships within the ESCP’s experiences during its first two years of operations. First, partners from all sectors valued that the leadership was placed within a third-party organization. This intermediary leadership structure not only provided a zone of neutrality relative to a structure in which leadership was housed within a K-12 or post-secondary institution, but also provided significant benefits in terms of administrative support, planning for sustainability and garnering financial support from the community. Partners perceived that there were significant benefits to leadership working between groups rather than from within any one stakeholder group although this recognition did not necessarily extend beyond the most involved partners as evidenced by partner concern that the general public lacked an understanding of the hub’s role. This implies that a public focus on the distinct value of intermediary leadership could be useful. Additionally, when making staffing decisions, partnerships may benefit from considering the types of personal traits Woodford and Banks embody since partners attributed much of the ESCP’s successes to these individuals’ capabilities.

The wide public involvement in planning the ESCP hub was rather a double-edged sword, with both benefits and unforeseen complications resulting. The broadly inclusive process
served to provide a wide base of support for the ESCP’s work and to garner initial publicity for the hub as well. At the same time, however, staff was left with a formidable list of short-term goals, several of which turned out to be impractical or impossible. While ESCP staff were able to negotiate this list of goals effectively with no funding repercussions, it is conceivable that, with a less flexible funding source, they may have had to expend considerable time and energy in working around such objectives or may have had to expend limited human resources on unproductive activities such as the e-newsletter and convening and moderating task forces with low participation rates.

In spite of the challenges that are associated with a broad-based effort, there is distinct value in bringing diverse stakeholder groups together during the early stages of a partnership, particularly in STEM education partnerships that rely on building bridges between workforce and education. Building bridging social capital between sectoral representatives is a complex business, and conceptualized differently among groups. K-12 stakeholders, for instance, may feel “apprehension” (Nick Browning) about reaching out to business or post-secondary stakeholders. The partnering component of the ESCP’s STEM Fellows program is an innovative way to address this phenomenon via professional development, and training a cadre of STEM Fellows who will then provide professional development to other educators is an efficient use of resources. This model of providing partnering support in the form of professional development may be useful to initiatives that wish to foster such relationships.

The findings of this study also highlight the importance of institutional cultures in partner engagement. The changing leadership at the four-year university may have contributed to the finding that other stakeholder groups perceived little engagement from the institution, for instance. Alternatively, business stakeholders work in institutional cultures that may allow them
little time for partnership work, and targeting specific and high-return activities leveraging institutional competencies may be the most effective way to engage some business stakeholders. Community groups and non-profit organizations often work under pressure to secure funds for their own missions, and it is possible that these organizations may see the intermediary partnership organization as a competitor for limited funds. Partnership efforts should be mindful of the potential pitfalls of working across groups, and combine strategic engagement with open communication to navigate the diversity of institutional cultures.

**Implications for STEM education reform**

This study highlights several points relevant to STEM reform initiatives in general. First, since STEM education’s workforce development goals rely on engaging business with education via cross-sector partnerships (CTEq, 2012; NSTC, 2011; Johnson, 2012; STEMx, n.d.), policy makers may wish to attend to the particular successes and challenges of this federally funded partnership. In particular, the use of an intermediary organization for leadership offered significant benefits both in terms of infrastructure support and perceived neutrality of leadership. At the same time, however, the intermediary position of leadership makes the partnership especially vulnerable to funding cuts since the role of the intermediary may not be well understood by the public. This highlights the need for intermediary organizations to have distinct identities and plans for sustainability in order to carry the momentum of their work past the initial funding phases.

In addition, STEM reform initiatives that rely on private sector businesses to drive systemic change are likely to meet with only limited success. Because of the propensity for the business sector to provide project-based, short term funding rather than long term investments (Adelman & Taylor, 2003; Kania & Kramer, 2011), business-led initiatives may lack the will to
“stay the course” (Johnson, 2012, p. 55) in the long-term. This implies a need for strategic planning for partnership funding from the outset of a partnership. This may be an area in which corporate partners in the financial industry could provide innovative plans for partnership funding. J.P. Morgan Chase’s (2013) $250 million investment in workforce development initiatives signals the interest of the financial industry in workforce development programs, and a financial sector initiative geared toward creating innovative structures for long-term partnership funding may be a way to leverage the unique competencies of such organizations to enhance the sustainability of STEM education partnerships.

The findings of this study provided little insight into the complex task of measuring outcomes of STEM reform initiatives. Rather, this study highlighted the complexities of creating longitudinal metric systems with short term grant funding, and revealed strong biases against using student level test scores to track change. Given the vast technical capabilities of STEM industries in the United States, data system creation may be another area in which industry can be engaged in a targeted manner.

**Implications for collective impact theory.** Collective impact theory was a useful lens through which to examine the ESCP’s efforts at building an infrastructure for regional STEM education reform. The five themes associated with collective impact fail, however, to fully capture and operationalize constructs related to collaboration. Although the elements of trust and communication are included within the continuous communication theme, this theme falls short of capturing the nuances of collaborative relationships. Further operationalization of the five existing themes may be useful in applying collective impact in future research, as may inclusion of a theme that reflects partner engagement and collaboration within a partnership.
In addition, developing a quantitative measure of collective impact may enhance future research efforts. The use of the Wilder Collaboration Factors Inventory in this study provided a model of how such a measure could be used in investigating or evaluating a collective impact organization, however it also highlighted the difficulties associated with adapting an existing instrument into a new context. The lack of constructs to assess the shared measurement systems theme was a particular shortcoming of the instrument in this case, pointing to the need for an instrument that reflects the constructs associated with collective impact more closely.

**Implications for the use of mixed methods in studying partnerships.** The use of a mixed methods case study design in this study provided an example of the depth and insight that strategic integration of data sources can provide in examining a partnership. In particular, the inclusion of a quantitative collaboration measure lent insight into potential weaknesses in bridging social capital and partner engagement among some stakeholder groups within the ESCP that may not have emerged from interview findings alone. While interview data provided rich individual perspectives on the ESCP, including a partnership-wide measure of collaboration significantly enhanced these findings and suggested areas for further investigation that will be discussed below. Future investigations into educational partnerships may be enhanced by employing the mixed methods case study design because of its ability to provide a rich case description while incorporating quantitative data from a larger sample to create a unified interpretation of the case.

**Limitations**

The results of this study are subject to several limitations inherent to data collection and analysis. The quantitative portion of the study was hindered in its generalizability by the small sample size and virtual non-response by one stakeholder group to the Wilder Collaboration
Factors Inventory. This, and the manner in which the data was aggregated for LOC scores, prevented the use of inferential statistics to discern group differences. Furthermore, low alpha reliability scores for some factors and the inability to calculate reliability statistics for single item factors suggests that the survey instrument may lack reliability for some factors. In addition to this, the fact that the survey lacks items to measure the shared measurement systems construct limited its usefulness in this context.

Furthermore, this case study is limited by the relatively small number of interviews conducted. Since only eight out of approximately fifty partners were interviewed, it is possible that some perspectives were unrepresented among the interview participants, particularly since the region is geographically and demographically diverse. Indeed, this highlights one of the limitations of using mixed methods research designs. Limited time and resources meant that qualitative sample sizes were relatively small and that it was not feasible to develop a survey instrument specific to this context.

It is also important to note the temporal limitations of the study. As noted, the study was conducted two years into the ESCP’s operations and just before the end of its grant funding. It is likely that the organization’s operations will alter in accord with its funding streams, and that partner perspectives regarding the ESCP and its leadership may alter as well.

Finally, the theoretical framework used limits the findings of this study. The framework of collective impact was not conceived for use in academic research, and therefore a number of subjective judgments were made regarding its use in this case. Another researcher may have interpreted the findings within this framework differently.

Future Research
There is much to be learned in the domain of cross-sector educational partnerships in general and partnerships for STEM education reform more particularly. This study has several implications for the use of mixed methods research to investigate cross-sector social partnerships. Besides methodological implications, this study has implications for areas of focus for future inquiry into educational partnerships.

First, this study provides a model for the use of collective impact theory as a framework for such investigations. The combination of a typological approach to analyzing qualitative data combined with quantitative data that related to these themes was useful and provided a more nuanced understanding of the ESCP’s infrastructure from a variety of partner perspectives than would have either method in isolation. While this model was useful, it also pointed to some areas that could be further refined in future research. In particular, a more robust survey instrument to gather data from large numbers of partners concerning collaboration would be useful to the field. While the Wilder Collaboration Factors Inventory provided a useful compilation of literature-based constructs, it fell short in measuring all five conditions of collective impact and had low reliability scores for some constructs. Further mixed methods studies to refine this instrument or to develop a new quantitative instrument would be beneficial to this field of inquiry.

The use of an intermediary organization to lead the ESCP provided an opportunity for a unique-case investigation into this partnership. The findings of this study could be extended by the use of a comparative case study approach in which STEM educational partnerships with various organizational structures are compared. In addition, because of the value of networking noted by stakeholders in this study, it may be useful to employ networking theory as a framework for such studies.
The findings of this study also suggested several other areas in which research could expand the understanding of educational partnerships. In particular, a further investigation into K-12 educators’ feelings of self-efficacy about professional networking outside the K-12 sector may have implications for educational partnership work. In addition, further investigation into the effects of policy that may alternately encourage students to pursue regionally relevant career skills versus broader skills that may lack regional relevancy could yield interesting insights for regional partnership work. Finally, research into developing measurement systems for cross-sector educational partnership initiatives has the potential to guide partnerships as they attempt to balance the use of student level data with economic development data to produce comprehensive longitudinal progress measures supported by developmental data.

Conclusion

While the findings of this study are most closely applicable to the ESCP and similarly situated educational partnerships, some key points emerged that are worthy of consideration by a larger audience. The ESCP was clearly a well-conceived partnership with a broad base of community support, yet its sustainability ultimately rests upon the capacity of the organization to raise funds for its sustainability and the willingness of community stakeholders to invest in its operations. The hub’s ability to engage partners and to identify mutual benefit among stakeholders is, therefore, key to its continued work. Coupled with that, school systems’ willingness and capacity to invest in the ESCP’s professional development programs in the future and to permit educators the flexibility to create communities of practice and partner with community stakeholders will impact the creation of STEM educational capacity in the region. Policy makers providing seed funding to such partnership efforts should attend to the ability and willingness of fledgling partnerships to prepare themselves for sustainability. Engaging
collective community action for educational change is a complex undertaking. Only by understanding and planning for the vagaries and potential pitfalls of partnerships can investments in cross-sector educational partnerships bear fruit and result in lasting change in our nation’s STEM education landscape.
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Appendix A

Participant Recruitment Emails

Email to Managing Director, Karen Banks

Subject: Interviews for ESCP dissertation project

Dear Karen,

As we’ve discussed, I’m looking forward to studying the ESCP for my dissertation project. Because of your close involvement and depth of knowledge about the organization, I’d like to interview you twice over the course of my project – once to collect some baseline background information and then later to follow up with some additional questions. Would you be willing to do this?

I plan to be in Eastville from January 13 to 17, 2014. I am available to meet at your convenience during that time and anticipate that our interview will last about one hour. Alternatively, we could arrange an interview by Skype at your convenience.

Attached is a more detailed description of this study. Please read over it and feel free to contact me with any questions you may have.

Additionally, I would like to access some documents describing the hub’s work including the ESCP’s application to the SSCA, your strategic plan, and any other documents that you think might be useful in this study.

If you have any queries concerning the nature of the study need clarification of anything, please contact me at waltonjo@mail.uc.edu or at 513-600-1741.

Thank you for your time and cooperation.

Sincerely,

Janet Walton
Email to Learning Director, Sheila Woodford

Subject: Interviews for ESCP dissertation project

Dear Sheila,

I am a doctoral student in Educational Studies at the University of Cincinnati under the advisement of Dr. Carla Johnson and Dr. Jonathan Breiner. I’ve communicated with Karen Banks about conducting a dissertation study on the ESCP and how the partnership enacts change in STEM education in your region. I am contacting you to request that you take part in the study by participating in interviews.

Because of your close involvement and depth of knowledge about the organization, I’d like to interview you twice over the course of my project – once to collect some baseline background information and then later to follow up with some additional questions. Would you be willing to do this?

I plan to be in Eastville from January 13 to 17, 2014. I am available to meet at your convenience during that time and anticipate that our interview will last about one hour. Alternatively, we could arrange an interview by Skype at your convenience.

My study is focused on exploring how the ESCP creates an infrastructure for regional change in STEM education. I plan to answer this overarching question by investigating the following questions:

1) What does the overall characteristics of the partnership?
2) What progress has the partnership made toward creating an infrastructure for change?
3) What is the level of collaboration in the partnership?

Attached is a more detailed description of this study. Please read over it and feel free to contact me with any questions you may have.

If you have any queries concerning the nature of the study need clarification of anything, please contact me at waltonjo@mail.uc.edu or at 513-600-1741.

Thank you for your time and cooperation.

Sincerely,
Janet Walton
Email to Partner Participants - Interviews

Subject: Interview regarding the ESCP for dissertation study

Dear [Participant],

I am a doctoral student in Educational Studies at the University of Cincinnati under the advisement of Dr. Carla Johnson and Dr. Jonathan Breiner. I’m excited to be conducting a dissertation study on the ESCP and how the partnership enacts change in STEM education in your region. As an involved partner, your insights and perspectives are a valuable part of this project.

[ staff member name] provided me with your contact information and I am interested in talking with you to gain an understanding of what is happening in the ESCP. Specifically, I’m interested in finding out how the hub is leveraging collective impact, a community-based approach to change, in your region. The interview will take approximately one hour and can take place at a location of your choice. I plan to be in Eastville from January 13 to 17, 2014 if you are available during that time or, alternatively, we could arrange an interview by Skype at your convenience.

Attached is a more detailed description of this study. Please read over it and feel free to contact me with any questions you may have. If you have any questions I can be reached at waltonjo@mail.uc.edu or at 513-600-1741.

I look forward to hearing from you and hope to have the opportunity to meet you in person.

Sincerely,
Janet Walton
Email to Partner Participants – Survey

Subject: ESCP Partnership Survey

Dear [Participant],

I am a doctoral student in Educational Studies at the University of Cincinnati under the advisement of Dr. Carla Johnson and Dr. Jonathan Breiner. I am conducting a dissertation study on the ESCP and how the partnership enacts change in STEM education in the region. As a partner, your insights and perspectives are a valuable part of this project.

As part of the study I am asking hub partners to complete a survey regarding their experience in the partnership. The survey is available on-line and should take about fifteen minutes to complete.

This survey is intended to measure factors of collaboration among ESCP partners and is part of a larger study to understand how the ESCP creates an infrastructure for regional change in STEM education. A more complete description of the study is provided in the attached document.

Please note that your participation in this study is voluntary. Your responses will be anonymous and no personally identifying information will be collected. The results of the study will be used for scholarly purposes only.

To complete the survey please use the following link:

Please feel free to contact me with any questions at waltonjo@mail.uc.edu or at 513-600-1741.

Thank you for participating in this project.

Sincerely,
Janet Walton
Appendix B

Interview Protocols

ESCP Staff Interviews I

Thanks so much for agreeing to be part of this study. I’m looking forward to learning more about your work here, and hearing your insights about what’s happening in the Eastville area. With your permission I’d like to record this interview. Do I have your permission to record our conversation?

1. I’d like to understand your background – how did you come to be involved in the ESCP?
2. Please describe for me how the ESCP got its start? (follow ups: When was that? Who was the driving force behind the ESCP’s inception?)
3. How would you describe the ESCP’s structure? (follow ups: How many partners are there now? What role does the RFE play in the partnership?)
4. What do you think the value is of using a partnership to improve STEM education outcomes in the region?
5. What is the ESCP’s vision or mission? (follow-ups: How was that conceived?)
6. How would you describe your strategy for achieving that vision? (follow-up: What short term goals do you use to benchmark your progress?)
7. What are the ESCP’s accomplishments to date?
8. How do you engage new partners in the ESCP’s work?
9. I’d like to understand the ESCP’s current and future funding structures – how would you describe those? (follow-up: How do you anticipate that the ESCP will be funded after federal funding expires?)
10. I’d like to review any documents you might have pertaining to the ESCP’s formation and strategic goals. Specifically, may I access a copy of the application to the SSCA? Also, do you have a strategic planning document? May I obtain a copy of that?
11. I’d like to follow up with you with some more questions in about two weeks. In the meantime, do you have anything you’d like to add about the ESCP’s structure and work?

Thank you so much for your time. I’ll be in touch about talking again, but if you have any questions or anything you’d like to add in the meantime, please feel free to contact me.
ESCP Staff Interviews II

Thank you for agreeing to talk with me again. With your permission I’d like to record this interview. Do I have your permission to record our conversation?

We talked last time about how the partnership is structured and what its goals and accomplishments are. I’d like to follow up with a few more detailed questions about the partnership.

1. How would you describe the relationships between partners? (Follow-up: How do partners from various sectors interact?)

2. How would you describe the PEF’s role in partner relationships?

3. How are partner roles defined?

4. How does the ESCP measure its progress? (Follow-up: How do you collect data about the partnership’s activities? How do individual partners track their activities or contributions? What shared measurement systems do you have in place?)

5. I’d like to understand communication within the partnership – how does communication happen? (Follow-up: Who initiates communication? Who is involved? What frequency?)

6. What do you think is the ESCP’s most important priority over the next year?

7. Do you have anything else to add?

8. I’d like to ask for your input on the narrative I create about the ESCP. Will you be willing to review that for accuracy if I send it to you via e-mail?

Thank you so much for your time. Please let me know if you have any questions or think of anything else you’d like to add.
Partner Interview Protocol

Thanks so much for agreeing to be part of this study. I’m looking forward to learning more about your work here, and hearing your insights about what’s happening here in the Eastville area. With your permission I’d like to record this interview. Do I have your permission to record our conversation?

1. I’d like to understand your background - how did you, and your organization, come to be involved in the ESCP? (Follow-up: How were you involved in the planning process? What is your organization’s motivation for being involved?)

2. How would you describe the ESCP’s vision?

3. How would you describe the ESCP’s strategy to achieve that vision?

4. What do you think the value is of using a partnership structure to improve STEM education in the region?

5. What do you think are partners’ roles in the ESCP?

6. How would you describe your relationship with other partners? (Follow-up: How do you interact with partners from other sectors [i.e., business partners with K-12, etc.] How do partners work together? How are roles defined?)

7. How does the ESCP measure its progress? (Follow-up: Does your organization collect any data relating to its participation?)

8. How does communication in the ESCP work? (Follow-up: Who initiates communication? Who is involved? What frequency?)

9. What is the role of the RFE in the partnership? (Follow-ups: What resources does it bring?; What challenges are presented by using an intermediary organization to coordinate partnership activities?)

10. Is there anything else you’d like to add about the ESCP’s work or your role in it?

Thank you for your time. I may want to contact you via e-mail to review some preliminary analysis of our interview for accuracy. Would you be willing to do that?

I will leave you my contact information in case you have any questions or think of anything else you’d like to add. Thank you again for your participation.
Appendix C

Wilder Collaboration Factors Inventory

Introduction

This survey seeks to measure partners' perceptions of collaboration in the [Redacted] Hub. The survey is part of a larger dissertation study to understand how the SETN, as an intermediary-led partnership, creates an infrastructure for regional change in STEM education. Your participation as a Hub partner is much appreciated.

Please note that your participation in this research project is voluntary. Your responses will be anonymous and no personally identifying information will be collected. The results of the study will be used for scholarly purposes only.

The survey is an adaptation of the Wilder Collaboration Factors Survey designed to measure factors that research has shown to be important to the success of a collaborative effort. It is composed of a brief background information section and forty items on a five-point scale. The survey should take about 15 minutes to complete.

If you have any questions, please contact Janet Walton at waltonjo@mail.uc.edu or at 513--600--1741.

Background Information

Please indicate which sector best describes your organization

- K-12 Education
- Postsecondary Education
- Business
- Community Group/Non-profit Organization
- Other (Please specify)

Is your organization currently a partner in the [Redacted] Hub?

- Yes
- No
- Not now, but has been in the past
- Not sure

How would you describe your involvement, as a representative of your organization, in the Hub's activities?

- I am actively involved in hub activities (participate in meetings or activities regularly--at least once a month)
- I am somewhat involved in hub activities (participate in meetings or activities occasionally--at least quarterly)
- I have little involvement in hub activities (rarely participate in meetings or activities)
- I have no involvement in hub activities
Please indicate your level of agreement with the following items.

1. Agencies in our community have a history of working together.
   - Strongly Disagree
   - Disagree
   - Neutral, No Opinion
   - Agree
   - Strongly Agree

2. Trying to solve problems through collaboration has been common in this community. It's been done a lot before.
   - Strongly Disagree
   - Disagree
   - Neutral, No Opinion
   - Agree
   - Strongly Agree

3. Leaders in this community who are not part of the [redacted] seem hopeful about what we can accomplish.
   - Strongly Disagree
   - Disagree
   - Neutral, No Opinion
   - Agree
   - Strongly Agree

4. Others in this community who are not part of the [redacted] generally agree that the organizations involved in this collaborative project are the "right" organizations to make this work.
   - Strongly Disagree
   - Disagree
   - Neutral, No Opinion
   - Agree
   - Strongly Agree

5. The political and social climate seems to be "right" for starting a collaborative like the [redacted] Hub.
   - Strongly Disagree
   - Disagree
   - Neutral, No Opinion
   - Agree
   - Strongly Agree

6. The time is right for the [redacted] Hub.
   - Strongly Disagree
   - Disagree
   - Neutral, No Opinion
   - Agree
   - Strongly Agree
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<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
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<tr>
<td>7. People involved in the Hub always trust one another</td>
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<td>8. I have a lot of respect for the other people involved in the Hub</td>
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<td>9. The people involved in the Hub represent a cross section of those who have a stake in what we're trying to accomplish.</td>
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<td>10. All the organizations that we need to be members of the Hub group have become members of the group.</td>
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<td>11. My organization will benefit from being involved in the Hub</td>
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<td>12. People involved in the Hub are willing to compromise on important aspects of our projects.</td>
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<td>13. The organizations that belong to the Hub invest the right amount of time in our collaborative efforts.</td>
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<td>Strongly Disagree</td>
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<td><strong>Everyone who is a member of the</strong> Hub wants our projects to succeed.</td>
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<tr>
<td>15.</td>
<td><strong>The level of commitment among the</strong> Hub partners is high</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
</tr>
<tr>
<td>16.</td>
<td><strong>When the</strong> Hub makes major decisions, there is always enough time for members to take information back to their organizations to confer with colleagues about what the decision should be.</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
</tr>
<tr>
<td>17.</td>
<td><strong>Each of the people who participate in decisions in the</strong> Hub can speak for the entire organization they represent, not just a part.</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
</tr>
<tr>
<td>18.</td>
<td><strong>There is a lot of flexibility when decisions are made; people are open to discussing different options.</strong></td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
</tr>
<tr>
<td>19.</td>
<td><strong>People in this collaborative group are open to different approaches to how we can do our work. They are willing to consider different ways of working.</strong></td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
<td>☐️</td>
</tr>
<tr>
<td>20. People in the [Redacted] Hub</td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral, No Opinion</td>
<td>Agree</td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>----------------------------------</td>
<td>-------------------</td>
<td>---------</td>
<td>-------------------</td>
<td>-------</td>
<td>---------------</td>
</tr>
<tr>
<td>have a clear sense of their roles and responsibilities.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>21. There is a clear process for making decisions among the partners in the [Redacted] Hub</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>22. The [Redacted] Hub is able to adapt to changing conditions, such as fewer funds than expected, changing political climate, or change in leadership.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>23. The [Redacted] Hub has the ability to survive even if it had to make major changes in its plans or add some new members in order to reach its goals.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>24. The [Redacted] Hub as tried to take on the right amount of work at the right pace.</th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>
25. We are currently able to keep up with the work necessary to coordinate all the people, organizations, and activities related to the Hub’s work.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

26. People in the Hub communicate openly with one another.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

27. Strongly Neutral, No

<table>
<thead>
<tr>
<th>Disagree</th>
<th>Disagree</th>
<th>Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

28. The Hub staff and leadership communicate well with members.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

29. Communication among the people in the Hub happens both at formal meetings and in informal ways.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

30. I personally have informal conversations about the Hub’s work with others who are involved in the Hub.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Disagree</td>
<td>Disagree</td>
<td>Neutral, No Opinion</td>
<td>Agree</td>
</tr>
<tr>
<td>---</td>
<td>------------------</td>
<td>----------</td>
<td>---------------------</td>
<td>-------</td>
</tr>
<tr>
<td>31.</td>
<td>I have a clear understanding of what the [redacted] Hub is trying to accomplish.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>32.</td>
<td>Partners in the [redacted] Hub know and understand the Hub's goals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>33.</td>
<td>Partners in the [redacted] Hub have established reasonable goals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>34.</td>
<td>The people involved in the [redacted] Hub are dedicated to the idea that we can achieve the Hub's goals.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>35.</td>
<td>My ideas about what the Hub is trying to accomplish seems to be the same as the ideas of others.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
<tr>
<td>36.</td>
<td>What we are trying to accomplish with the Hub's work would be difficult for any single organization to accomplish by itself.</td>
<td>☐</td>
<td>☐</td>
<td>☐</td>
</tr>
</tbody>
</table>
37. **No other organization in this community is trying to do exactly what we are trying to do.**

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

38. **The [redacted] Hub has adequate funds to do what it wants to accomplish.**

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

39. **The [redacted] Hub has adequate "people power" to do what it wants to accomplish.**

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

40. **The people in leadership positions for the [redacted] Hub have good skills for working with other people and organizations.**

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral, No Opinion</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

Thank you for completing this survey. Please click on the arrow button to submit your responses.
Appendix D

Study Information & Consent Form
University of Cincinnati
Department: Educational Studies
Principal Investigator: Janet Walton
Faculty Advisors: Carla Johnson, Jonathan Breiner

Title of Study:
Partners for Change: A Mixed Methods Case Study of an Intermediary-led STEM Education Partnership

You are being asked to take part in a dissertation study. Please read this document carefully and ask questions about anything that you do not understand.

Who is doing this study?
The person in charge of this study is Janet Walton of the University of Cincinnati (UC), Department of Educational Studies

What is the purpose of this study?
The study is focused on exploring how the ESCP creates an infrastructure for regional change in STEM education. This overarching question will be answered by investigating the following questions:

1) What are the overall characteristics of the partnership?
2) What progress has the partnership made toward creating an infrastructure for change?
3) What is the level of collaboration in the partnership?

Who will be in this study?
ESCP staff and partners.

What will you be asked to do in this study, and how long will it take?
You will be asked to participate in an interview regarding your understanding of how the ESCP has progressed in five areas associated with organizations that successfully implement collective impact. It will take about one hour to conduct the interview and will take place in a setting of your choice. I will ask ESCP staff members to participate in two interviews in order to more fully understand the partnership’s work and progress.

With your consent, the interview will be recorded.

Are there any risks to being in this study?
The level of risk in this study is minimal.

Are there any benefits from being in this study?
While there are no direct benefits to you from participating in this study, although the ESCP staff and partners may find benefit in understanding more about the ESCP’s efforts and progress. Additionally, you may find some benefit in reflecting upon your involvement in the ESCP and...
the ESCP’s progress.

**What will you get because of being in this study?**
There are no incentives being offered for participation.

**Do you have choices about taking part in this study?**
If you do not want to take part in this study you may decline to participate.

**How will your study information be kept confidential?**
Information about you will be kept private by assigning a pseudonym to your information. Additionally, the raw data will only be accessible by the PI and her dissertation committee.

Your information will be kept confidential for the duration of the dissertation process. Upon successful defense of the dissertation, all data will be destroyed; electronic data will be deleted and paper documents shredded.

Agents of the University of Cincinnati may inspect study records for audit or quality assurance purposes.

**What are your legal rights in this study?**
Nothing in this form waives any legal rights you may have. This consent form also does not release the investigator, the institution, or its agents from liability for negligence.

**What if you have questions about this study?**
If you have any questions or concerns about this study, you should contact Janet Walton at waltonjo@mail.uc.edu

The UC Institutional Review Board reviews all research projects that involve human participants to be sure the rights and welfare of participants are protected.

If you have questions about your rights as a participant or complaints about the study, you may contact the UC IRB at (513) 558-5259. Or, you may call the UC Research Compliance Hotline at (800) 889-1547, or write to the IRB, 300 University Hall, ML 0567, 51 Goodman Drive, Cincinnati, OH 45221-0567, or email the IRB office at irb@ucmail.uc.edu.

**What if I choose not to participate in this study?**
Your participation in the study is optional. Refusing to take part will not cause any penalty or loss of benefits that you would otherwise have. You may start and then change your mind and stop at any time. To stop being in the study, you should tell the PI at your earliest convenience.

**Agreement:**
Participation in the interviews will imply your agreement with this document and your consent to be interviewed.