Strategic Partnerships: MiSTEM's Efforts to Bridge Business and Education for Michigan's Future Workforce

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Table of Contents

Executive Summary

This capstone project explores business and education partnerships. Our partner organization, the MiSTEM Network in Michigan, was created to better prepare students for high-demand, high-skilled careers. MiSTEM is working to bridge the skills gap by catalyzing partnerships between businesses and K–12 educators to prepare students for the future workforce. We used interviews, a focus group, and document analyses to investigate how MiSTEM communicates the mutual benefits of partnerships, the factors that influence the costs and benefits of these collaborations, and the strategies MiSTEM employs to recruit and retain business partners. During our analysis, we observed inconsistencies in how MiSTEM conveys the mutual benefits of business and education partnerships across marketing and communication channels. We learned that loosely defined structures, scarce resources, and misalignment in shared values negatively impact partnership costs. In addition, we identified a growing need for a comprehensive business and technical strategy to recruit and retain business partners.

Our recommendations signal the need for consistent messaging on the mutual benefits of business and education partnerships across MiSTEM's regional websites. We propose that the value of integrating business and education partnerships should be clearly articulated through a comprehensive marketing tool, and steps should be taken to expand the usage of underutilized communication channels to enhance communication during the various stages of the partnership. Furthermore, MiSTEM should serve as a connector between businesses and educators. We advocate for aligning partners based on their shared values, using a partnership charter to clarify responsibilities, and effectively leveraging resources to reduce the costs of partnerships. Finally, we see value in implementing a customer relationship management system and a comprehensive recruitment and retention strategy to support MiSTEM's activities.

Introduction

Organizational Context

Our partner organization is the MiSTEM Network, which has an office within the Michigan Department of Labor and Economic Opportunity (LEO). It works closely with the Michigan Department of Education (MDE) and is guided by the MiSTEM advisory council.

> The MiSTEM Advisory Council was created in 2015 under MCL 388.1699s and organized under the Department of Labor and Economic Opportunity per Executive Order No. 2019-13. The Council is made up of 11 voting members serving at the pleasure of the Governor and four ex-officio legislators appointed from the House of Representatives and Senate (MiSTEM Advisory Council, 2022).

The MiSTEM network comprises 16 regions across the state: 13 in the lower peninsula and three in the upper peninsula. As an organization, MiSTEM is structured around four pillars: creating a STEM culture, empowering STEM teachers, ensuring high-quality STEM experiences, and integrating business and education (see Figure 1).

Figure 1

MiSTEM Pillars

Note. Adapted from (https://mistem.resa.net/who-we-are/#4pillars)

MiSTEM's mission is “to be the catalyst for equitable access to authentic STEM experiences in every community in Michigan,” and their vision is to “empower the next generation of innovators to create more inclusive and prosperous communities of tomorrow" (MiSTEM Advisory Council & MiSTEM Network, n.d.-a). According to the governor of Michigan's most recent FY2024 budget (Executive Office of the Governor Communications Division, 2023), in addition to supporting a range of educational initiatives, the state will be allocating resources to support public health initiatives; rebuilding roads; developing housing; investing in clean energy, electric vehicles, and information technology; protecting groundwater and drinking water; boosting resilience in food system infrastructures; expanding internet access; investing in security; and re-opening power plants. These investments signal that Michigan's budgetary initiatives will generate STEM jobs that require STEM skills. According to the Michigan Economic Development Corporation (n.d.), the state’s core industries include advanced manufacturing, life science and medical device companies, mobility and automotive manufacturing, professional and corporate services, technology, engineering, design and development, semiconductors, defense, and aerospace, all of which require STEM skills for success.

In addition to creating more STEM jobs, the state is also working to proactively recruit and retain companies through Michigan's new economic development plan, which was launched in May 2023 in response to direct feedback from the Michigan business community that focused on actionable steps that the state could implement to expand and attract more businesses for the state (Hendrickson, 2023). Under this new initiative, the state will invest in training and upskilling the labor force, bring manufacturing jobs and supply chains back to the state, support innovation and entrepreneurship in the business community, and invest in revitalizing communities (Executive Office of the Governor Communications Division, 2023). To help Michigan "become a world leader in STEM education" (MiSTEM Advisory Council & MiSTEM Network, n.d.-a), MiSTEM will need to align its efforts toward developing the talent required to support the governor's "Make it in Michigan" plan, which focuses on building the Michigan economy and a future where both communities and businesses can thrive.

Significance of the Problem of Practice

According to the United States Bureau of Labor Statistics (2022), STEM jobs are projected to grow 10.8% by 2031. The World Economic Forum’s (2023) Future of Jobs report indicates that some of the fastest-growing roles are in STEM areas, including artificial intelligence (AI), machine learning, sustainability, business intelligence, information security, renewable energy, and systems engineering. In addition, the report identifies employer concerns regarding the talent pipeline requiring more skills to meet demands (World Economic Forum, 2023). More specifically, “48% of companies identify improving talent progression and promotion processes as a key business practice that can increase the availability of talent to their organization” (World Economic Forum, 2023, p. 7).

Investing in partnerships that support the skilled technical workforce (STW) has gained significant attention at the national level (Mathieson et al., 2023). Recently, the National Science Board released a report that identified four issues that must be addressed through strategic partnerships:

1. Designing STW education and preparation to meet the needs of individuals
2. Building partnerships among education, industry, nonprofit, and government sectors to leverage resources and knowledge and meet the needs and circumstances of local communities

3. Conveying accurate information about employment and career opportunities in the STW
4. Addressing data gaps and data silos so that government, industry, and educational institutions can maximize the effectiveness of programs and initiatives (National Science Board, 2019, p. 21)

At the national level, building skills in STEM is not only an opportunity but a necessity. With the United States ranking at 30 out of 64 countries in math (United States News and World Report, 2019), 20% of high school graduates indicating they are prepared for college-level STEM coursework (Herman, 2019), only 27% of the STEM workforce identifying as female (United States Census Bureau, 2021), and 9% of STEM workers identifying as black (Funk & Parker, 2018), the United States workforce is underprepared to meet the growing STEM skills requirement. In Michigan, "demand for workers in STEM is expected to grow at nearly twice the rate of all other jobs" (MiSTEM Advisory Council & MiSTEM Network, n.d.-c). However, the state needs help to meet this demand, which is where MiSTEM comes in.

MiSTEM is uniquely positioned to collaborate with the MDE and LEO to help prepare Michigan students for the changing employment landscape. Based on MiSTEM's 2022 Annual Report and 2023 Recommendations, the organization plans to focus grant funding on place, project, and problem-based learning (3-P); inspire STEM engagement; invest in business partnerships to deliver 3-P STEM experiences; and measure education and workforce outcomes (MiSTEM Advisory Council, 2022). The primary goal of forming business partnerships is to address the increasing demand for STEM careers and to prevent situations in which businesses relocate out of state in search of more qualified employees, as highlighted in Ainslie and Huffman's (2018) report. It is vital to communicate to businesses that the Michigan talent pipeline does not begin when students graduate from high school but rather in early childhood.

Research demonstrates that it is possible and beneficial for young children to participate in STEM learning since decisions to pursue a STEM career are impacted by educational experiences in elementary and middle school (Fouad et al., 2002). In addition, from a school perspective, it becomes apparent that children can acquire a greater understanding of STEM concepts and practices than educators initially presumed. This is supported by numerous studies that demonstrate a direct relationship between early exposure to STEM subjects and subsequent achievements (McClure et al., 2017). The Institute of Medicine and National Research Council (2015) noted that "without such education starting, and continuing, throughout the early years, many children will be on a trajectory in which they will have great difficulty catching up to their peers" (p. 119). Moreover, early exposure to STEM careers can ignite students' interest in learning and leverage their innate intellectual curiosity, which decreases over time (Chu et al., 2020).

However, motivating businesses and educators to support the network goals of closing the STEM gap, building the Michigan workforce, and keeping businesses in the state is only part of the problem. Investing in strategic partnerships also means investing in initiating and building relationships (MiSTEM Advisory Council, 2022). In a recent benchmark report conducted by the RAIN Group, Schultz et al. (2018) found that when attempting to initiate connections, 69% of firms want data relevant to their business, 67% want to know the capabilities of the potential partner, 67% want content that is customized to their specific business needs, and 96% want potential partners to focus on the value that can be delivered. On average, it can take up to eight touchpoints to initiate conversation (Schultz et al., 2018). These data emphasize that the process of recruiting and retaining partners is time-consuming and deeply relational (Eddy & Amey, 2014). The work demands a comprehensive outreach strategy that serves to create and nurture relationships that align with network goals; initiate, develop, and maintain a multi-channel communication strategy that provides connectivity to the network; and deliver a promise of relational exchange that will lead to co-creation of value, mutual benefits, and a return on investment of resources (Payne & Frow, 2013). If MiSTEM is truly interested in creating and sustaining relationships that will positively impact network-level goals, as part of a cross-functional approach, MiSTEM will need to effectively use technology to segment partners based on motivations, value, and resources; track engagement and touchpoints through multiple channels; and create greater insight and collaboration across a geographically dispersed network.

Purpose of Capstone

Michigan needs a pipeline of skilled STEM employees graduating from its schools to meet the growing needs in the state workforce. MiSTEM was created to better prepare students for in-demand careers of the future and “broaden the STEM ecosystem and embrace learning experiences beyond the physical classroom” (MiSTEM Advisory Council, 2022, p. 10). Since partnerships between businesses and K-12 educators are vital to realizing MiSTEM's objective, we aim to understand the current messaging strategy that is being used to convey the value of these partnerships, examine the costs and benefits of the partnerships, and analyze the activities that MiSTEM is engaging in to recruit and retain business partners.

Literature Review

Partnerships

At a fundamental level, partnerships have been described as a structure in which "different sets of actors – statutory bodies, the private sector, and community/voluntary agencies – each have a role in the local development process" (Walsh, 2004, p. 9). Bailey (1994) defined a public-private partnership as "a mobilization of a coalition of interests drawn from one sector in order to prepare and oversee an agreed strategy for a defined area or objective" (p.294). Walsh (2004) communicates that as part of this process, actors cooperate, share responsibility and accountability, develop trust, and work toward a common objective. The actors or partners must allow diverse perspectives, engage in joint decision-making and problem-solving, and commit to nurturing the partnership (Walsh, 2004).

According to Greer (2001), engaging stakeholders in partnerships can facilitate stability during economic, social, and political changes; empowerment and ownership that can contribute to the sustainability of programs; environments of synergy where stakeholders can achieve more as a team than as individuals; and the opportunity to attain resources and maximize stakeholder budgets. However, Greer also highlights that partnerships create disadvantages, including complex and overlapping alliances, challenges around a common approach, fragile and unsustainable partnerships, and issues of power and conflicting interests. Overall, a partnership's objective is to co-create value (Elo et al., 2023).

From an educational perspective, Bagnall (2007) has characterized partnerships as being "toward," "for," or "in" learning. Partnerships "toward" learning are at the system level; they promote learning but are not necessarily involved in the learning experience. Partnerships "for" learning operate at the school level, possibly through curriculum enhancements, and partnerships "in" learning assume that all parties are beneficiaries in the learning process (Bagnall, 2007). Regardless of how a partnership is characterized, business connections to STEM programming in K-12 environments can increase student participation and exposure to STEM careers (Mathieson et al., 2023). However, these partnerships are often developed using a teacher's social and professional network (Mathieson et al., 2023); Eddy and Amey (2014) describe such partnerships as *traditional partnerships*.

Eddy and Amey (2014) found that traditional partnerships alleviate resource constraints, supported unit-level work, and helped meet specific policy needs or shared, individually aligned values. *Strategic partnerships*, on the other hand, focus on finding the ideal partner to meet strategic or political objectives, align with a larger strategic plan, and build on dense networks (Eddy & Amey, 2014). While both traditional and strategic partnerships are useful, a traditional partnership is more likely to dissolve when an individual leaves a partnership—due to turnover or career changes resulting from the lack of shared partnership capital—while a strategic partnership is more enduring (Eddy & Amey, 2014). At their core, partnerships are sustained by relationships. Hence, relationships and the networks associated with them are highly influential in determining which partners are chosen and which partnerships are ultimately maintained or dissolved (Parmigiani & Rivera-Santos, 2011).

Networks

According to Gamper (2022), "it is generally assumed that people are embedded in relationships and cannot be viewed in isolation from their social environment" (p. 36). In addition, no person or organization has all the knowledge, expertise, and tools needed to tackle today's complex challenges (Lusch et al., 2009; Reypens et al., 2016). Thus, a business network can be described as an exchange system where actors are tied through interdependent business relationships (Anderson et al., 1994). Within this context, networks are tied through actors, resources, and activities that engage in resource and social exchange to achieve relational and economic benefits (Hakansson & Ford, 2002; Möller, 2013). Actors can be connected through strong, well-established relationships (ties) with high interaction or weak, underdeveloped relationships with limited interaction (Granovetter, 1973; Hakansson & Ford, 2002). While strong ties provide established support (Gamper, 2022), weak ties can provide access, information, and bridges to resources and connections that are not as easily accessible through strong ties (Granovetter, 1973).

Both strong and weak ties are essential to the diversity and stability of a network (Möller & Svahn, 2006). While some may describe networks as unmanageable (Hakansson & Ford, 2002), others consider them as relationships that can be shaped by *hub firms* (Ahola et al., 2020; Möller & Rajala, 2007). Within networks, members are often included or selected by existing members because they have complementary resources (Hitt et al., 2000; Matinheikki et al., 2017) that contribute to value co-creation activities (Vargo & Lusch, 2008). More importantly, members are selected because they share similar values and align with a system-level goal that generates benefits “not only for the network as a whole but also themselves, increasing their commitment to collective action in the network" (Matinheikki et al., 2017, p. 123). However, even though networks align toward a system-level goal, Möller and Svahn (2006) and Cross et al. (2005) identifies that networks can also be classified and characterized into three categories based on their underlying values, knowledge, level of determination, and capabilities. Möller and Svahn (2006) call these intentionally created business networks *nets*.

The first net focuses on networks where actors, activities, technology, business processes, and values are well-defined (Möller & Svahn, 2006). Cross et al. (2005) identifies this *routine* network as a standard process by which work is completed and value is realized through stability, consistency, and efficiency. Möller and Svahn (2006) call this network *current business nets*. The second net is the *business renewal net*, where values are well-established, but the process is not standard and small changes to work are likely (Möller & Svahn, 2006). Cross et al. highlights that these *modular* networks may know and understand the problem but value providing a unique response. Finally, in the *emerging new business nets,* the value system is not well-established, the actors are focused on generating new ideas, and value is most likely to be fully realized in the future (Möller & Svahn, 2006). In a *customized* response, value is also delivered by applying innovation to problems and solutions (Cross et al., 2005). Although each business net has varying values, knowledge, levels of determination, and capabilities (Cross et al., 2005), as Christopher et al. (2002) explains:

> Each member of the network specializes in that aspect of the value creation process, where it has the greatest differential advantage. This model of business activity sees the network, not the individual firm as the value delivery system……It suggests that sustainable advantage lies in managing the complex web of relationships that link highly focused providers of specific elements of the final offer in a cost effective, value adding network. The key to success in this new competitive framework is arguably, the way in which the network of alliances and suppliers are welded together in partnership to achieve mutually beneficial goals. (pp. 121-122)

Partnership Benefits and Outputs

It is generally assumed that individuals engage in relational exchange because the benefits of the exchange outweigh the costs (Hunt et al., 2006). According to the NSW Government Benefit Realization Framework (State of New South Wales, 2018):

1. A benefit is a measurable improvement resulting from an outcome which is perceived as an advantage by a stakeholder.
2. Benefits must be aligned with the organization's strategic goals.
3. Benefits need to first be understood as outcomes; benefits are the reason an investment is made.
4. Benefits must be measurable and evidence-based in order to demonstrate that an investment provides value.
5. Benefits can only be realized through change, and change can only be sustained by realizing benefits.
6. Benefits are dynamic; they need to be regularly reviewed and updated. (p. 5)

Business and academic partnerships can provide a wide range of mutual benefits. They can improve student achievement, increase test scores, improve employee satisfaction, develop a better-prepared workforce, and increase the community's economic health (Council for Corporate and School Partnerships, 2002). In a survey by Lee et al. (2016), businesses commented that they could outsource fewer employees and hire more local employees from a diverse candidate pool.

Partnership outputs allow students to apply theory to practice and engage in innovative learning experiences that expose them to new knowledge and experiential learning opportunities (Deeter-Schmelz, 2015). As part of a partnership, both students and teachers work with business practitioners, developing relevant STEM skills (Watters & Diezmann, 2013) and essential soft skills (Mathieson et al., 2023). Lastly, partnerships can provide access to funding that can increase students’ access and opportunities (Watters & Diezmann, 2013).

From a business perspective, academic and business partnerships can help shape the future workforce. Research has proven that habits and motivation toward careers begin early in K-12 environments (Pawloski et al., 2011). Through a shared vision and a unified goal of early access to quality STEM learning experiences, business and academic partnerships can successfully engage students in STEM education and career exploration (Sumberg, 2000; Watters & Diezmann, 2013). From a learning perspective, business partners can teach specialized skills, provide feedback on topics taught in the classroom (Deeter-Schmelz, 2015), and engage in the teaching experience (Watters & Diezmann, 2013). Regarding the return on investment for the organization, students will be exposed to necessary skills and career paths as the organization continues to engage in the educational experience. However, they will also be exposed to the company brand and culture (Deeter-Schmelz, 2015), and as they progress, stakeholders can develop relationships that could lead to future employment, thus reducing recruitment and talent acquisition costs.

Partnership Challenges and Costs

Although the literature highlights the benefits of academic and business partnerships, challenges and costs are also associated with these partnerships. Developing strong partnerships involves difficult work, and partners may experience challenges in securing reliable partners (Deeter-Schmelz, 2015), identifying clear goals (Morris et al., 2021), developing strong communication channels, and distributing the work equitably (Gillen et al., 2021). Decisions about which skills to teach, which careers to expose students to (Morris et al., 2021), and other curricular or school constraints can be burdensome (Gillen et al., 2021). From a cost perspective, when educators lack time to create, engage, communicate, teach, and improve it can strain the partnership (Deeter-Schmelz, 2015; Gillen et al., 2021; Morris et al., 2021). Business leaders cited taking time away from work, navigating the constraints of the school environment, competing work responsibilities, and managing the company's economic interests as partnership costs (Gillen et al., 2021). Similarly, school representatives mentioned time away from school responsibilities and ethical and public accountability costs as strains on the partnership (Gillen et al., 2021).

Partnership Motivation and Relationship Development

Understanding partner motivations is vital when recruiting and retaining partners (Lee, 2011). Three of the most prominent motivations in the literature focus on competitive advantage, collaborative advantage, and corporate social responsibility (Hunt et al., 2006; Lee, 2011). Partnerships provide access to networks with resources and expertise that are more easily acquired through partnerships than independently (Lee, 2011), providing a collaborative advantage. When partners pursue joint activities that co-create value, they deliver mutual benefits that cannot be achieved independently (Elo et al., 2023). For example, the Council for Corporate and School Partnerships (2002) found that educators are motivated to form partnerships to realize increased resources, positively impact student achievement and motivation, and access advanced technology and curriculum enhancements.

From a competitive advantage perspective, aspects such as product attribution, efficiency advantage, human capital, and a relational portfolio can inspire financial viability, support, and legitimacy from key stakeholders (Lee, 2011). For example, one of the primary motivations for businesses to engage in school partnerships is career exposure and recruitment for the future workforce (Lonsdale et al., 2011). In a study conducted by Lee et al. (2016), businesses highlighted opportunities for potential future employees to try a new job or industry and develop career-ready skills before making a long-term commitment. Moreover, they aimed to increase employability for individuals who may not attend college and turn them into human capital investments that create efficiencies for the organization while developing skills. According to Lee (2011), businesses identify that employee involvement in partnership activities can increase employee morale and retention. Moreover, organizations struggle to proactively manage increasing societal pressures to tackle social issues (Lee, 2011). Therefore, finding opportunities to pursue partnerships that highlight ethical behaviors and build brand, reputation, and credibility in the community can be strong motivators (Lee, 2011).

Relational drivers of partnerships, such as trust, commitment, satisfaction, and loyalty, are essential for relational success (Narayandas & Rangan, 2004). High levels of trust can lead to inter-organizational cooperation, commitment, and long-term satisfaction if partners keep their promises (Narayandas & Rangan, 2004; Sashi, 2012). According to Dwyer et al. (1987), relationships develop over time and undergo a series of stages, including awareness, exploration, expansion, commitment, and dissolution. In *awareness*, each party attempts to obtain a sense of the other as a potential partner. *Exploration* occurs when partners evaluate the costs and benefits of exchange and aspects of attraction, communication, power, norms, and expectations; in this stage the partners exchange resources, and based on the satisfaction of exchange, they experience trust and commitment. In *commitment,* parties exchange input, durability, and consistency in the partnership, and *dissolution* describes when the partnership is terminated. Based on Dwyer et al.'s (1987) relationship development process, partnerships must be nurtured at every relationship phase. Strategic engagement requires a comprehensive strategy that takes partners through a constantly evolving process of connection, interaction, satisfaction, retention, commitment, advocacy, and engagement, which allows them to build sustainable relationships (Sashi, 2012).

Communication

Communication is one of the most effective ways to build relationships (Hung & Lin, 2013; Sashi, 2021). Mohr and Spekman (1994) identify three aspects of communication that should be evaluated: communication quality, information sharing, and participation in planning and goal setting. *Communication quality* refers to the timeliness, accuracy, and relevance of disseminated communication. *Information sharing* refers to the frequency and type of information exchanged, and *participation* is the engagement of partners in the joint process of defining roles, responsibilities, expectations, goals, costs, benefits, outcomes, and outputs of the partnership, as well as problem-solving and joint decision-making (Mohr & Spekman, 1994). Effective engagement and communication with a partner are critical to success (Eddy & Amey, 2014).

When attempting to recruit and retain business partners, the literature highlights the importance of a planned communication strategy to facilitate interaction that can develop into a productive dialogue between potential partners (Grönroos, 2004; Kim & Kumar, 2018; Venkatesan et al., 2007). Fraccastoro et al. (2021) identify three major categories for communication tools: traditional (face-to-face, phone calls, and mailing), digital (email, websites, and video conferencing platforms), and social media (LinkedIn, Facebook, and Instagram). When considering the different communication channels presented, Ahearne et al. (2022) argue that face-to-face communication is the superior because of the verbal and physical cues exchanged in it. Although verbal and physical cues are slightly diminished in video conferencing platforms, they still contain verbal and physical richness, placing them second, with email and text ranking last (Ahearne et al., 2022).

Face-to-face contact has long been one of the principal methods of interaction, primarily because this mode of communication has proven successful in building trust, developing rapport, and creating bonds (Ahearne et al., 2022); it creates an excellent platform for influential tactics such as sharing information, providing recommendations, presenting promises, and delivering inspirational appeals (McFarland et al., 2006; Singh et al., 2020). Because face-to-face interaction allows individuals to process information simultaneously, it can reduce the cognitive burden on individuals during the exchange (Singh et al., 2020).

Although digital communication methods such as email provide a poorer communication experience (Ahearne et al., 2022), they also possess unique advantages in the relational exchange process (Singh et al., 2020), such as accessibility, efficiency, and frequency of exchange (Fraccastoro et al., 2021; Sashi, 2021; Singh et al., 2020). For example, websites provide access to a wide range of information that partners can acquire before meetings, to guide informed conversations (Ahearne et al., 2022). Moreover, when the individuals involved in the exchange are located in geographically diverse areas or when the number of people involved in the interaction is significantly higher, digital communication is preferred (Fraccastoro et al., 2021; Sashi, 2021). As the relational exchange progresses and individuals start to increase communication frequency (Dagger et al., 2009), digital communication methods create efficiencies in exchange with personalized messages and informational attachments that help evaluate the costs and benefits of an activity (Sashi, 2021; Singh et al., 2020). In addition, digital synchronous and asynchronous interactions can also assist with communicating the costs and benefits of partnerships, which ultimately helps meet the needs and expectations of the exchange (Gummesson & Mele, 2010; Sashi, 2021).

Fraccastoro et al. (2021) found that face-to-face interaction is still preferred when approaching prospects to build relationships; however, when identifying prospects and building awareness, social media is the preferred method for reaching a wider audience. In the conversion process, Fraccastoro et al. highlight customer relationship management (CRM) software as a preferred tool to segment populations, customize communication, and maintain records of transactions and personal interactions. Finally, social media is a key tool to use in combination with a CRM for sustaining long-term relationships (Fraccastoro et al., 2021; Lacoste, 2016).

Regardless of the medium chosen, Grönroos (2004) argues that all communication must be integrated into a planned communication strategy. According to Kim and Kumar (2018), the strategy should incorporate economic messages (focused on financial and economic resources) and relational marketing messages (focused on social and relational values). In addition, the strategy should disseminate the promise and value of the partnership, product, service, and unplanned messages (Grönroos, 2004). Moreover, the partners should make continued efforts to ensure that the messages reach the correct individuals in the organization (Cycyota & Harrison, 2006) and that communication is targeted to the partner's specific needs (Kim & Kumar, 2018). For example, well-established partnerships may require more relational marketing messages, while less-established partnerships may need a higher frequency of economic messages early in the relationship (Kim & Kumar, 2018). Haumann et al. (2015) asserts that as part of the strategy, all messages should remain focused on “relational and collective” goals (p. 29). Strategies highlighting the value, the benefits and costs, and the promise in exchange realized from the partnership may reduce perceived risk and encourage collaboration (Haumann et al., 2015). Relationships are unlikely to form if communication does not address the “wants, issues, inputs, and priorities” of the partners (Hung & Lin, 2013, p. 1229).

Success in Partnerships

The decision to collaborate does not in itself lead to success. Identifying a mission, vision, and core values and developing a shared understanding of objectives and expectations through dialogue and engagement are essential (Elo et al., 2023). Lee et al. (2016) found that organizations that developed a rationale for participating in partnerships perceived stronger benefits than those that did not. In addition, organizations that assigned staff members to the execution of the partnership perceived increases in employee motivation, skill development, and company brand recognition (Lee et al., 2016). When evaluating how to staff a partnership for success, Lee et al. found that partnerships that involved a broker or specifically assigned staff had greater success with reinforcing benefits, managing challenges, and meeting the objectives and goals of the partnership.

In addition to staffing, Elo et al. (2023) identifies seven themes that should consistently be evaluated when working toward operational success in a partnership: *leadership, internal engagement and ownership, communication and collaboration, resources and resourcing, continuous learning and competence development, continuous improvement,* and *continuous planning*. Within these themes, Elo et al. (2023) focus on the importance of leading with and for partners, taking ownership of the partnership, and ensuring a wide range of resources are integrated to support the evolution of the partnership.

Regarding business and school partnerships specifically, the Council for Corporate and School Partnerships (2002) lists specific actions that can be taken at three stages in the partnership process:

1. In the implementation phase, partnerships need to define roles; accountability; and specific, measurable outcomes; they should be supported by the school and business culture.
2. To sustain the partnership, support at all levels of both organizations is essential. Detailed communication plans should be developed to convey information, enhance collaboration, remain accountable for outcomes, and share successes.
3. Finally, when evaluating the success of the partnership, partners should regularly revisit measures of success and evaluate the process and outcomes.

Business and education partnerships that demonstrated strong communication and trust; allowed for collaboration across academic (STEM) disciplines; and provided opportunities for mentorship, job talks, and career fairs were classified as successful (Mathieson et al., 2023). As previously discussed, support for the partnership is an essential consideration in the literature, and the organizations much thoughtfully consider the diverse needs of the partnership for it to succeed. For example, while schools indicated flexibility with curriculum, leadership support, and resources as three critical components for success (Morris et al., 2021), businesses identified human resources and company support as necessary for sustainability (Gillen et al., 2021). When evaluating the most successful partnerships, research indicated that partnerships that align business and social goals and share the burdens and benefits of the partnership are able to achieve success (Gillen et al., 2021).

Theoretical Frames

Based on the literature, we seek to further examine the communication of mutual benefits, the costs and benefits of partnerships, and the activities associated with the recruitment and retention of partners, with a review of applicable theoretical frames. We have chosen the theories of social exchange, value co-creation, and relationship marketing to enhance our exploration.

Social Exchange Theory

Social exchange theory explores the idea that relationships are created and maintained through a cost-benefit analysis. The assumption is that actors will engage in and sustain a relationship as long as it provides benefits (Blau, 1986; Homans, 1958) and they can gain something from the interaction. Lambe et al. (2001) highlights four foundational elements of social exchange theory:

1. Exchange interactions result in economic and or social outcomes.
2. These outcomes are compared over time to other exchange alternatives to determine dependence on the exchange relationship.
3. Positive outcomes over time increase firms' trust of their trading partner(s) and their commitment to the exchange relationship.
4. Positive exchange interactions over time produce relational exchange norms that govern the exchange relationship (Lambe et al., 2001, p. 6).

A significant amount of the literature on social exchange focuses on reciprocity as well as rules. It emphasizes that exchange is dependent upon relational contracts and norms (Gouldner, 1960) that are collaborative and cooperative (Nevin, 1995) and continue to achieve outcomes that are more beneficial than those that could be achieved with and through another partner

(Nevin, 1995). An organization's dependence on the relationship is “directly proportional to A's motivational investment in the goals mediated by B and inversely proportional to the availability of those goals outside of the A-B relationship” (Emerson, 1962, p. 32). As the relationship develops, benefits must be reciprocated (Homans, 1958) for trust to develop (Blau, 1986) and relationships to move from transactional to relational. Trust becomes essential in the relationship as it can encourage organizations to focus less on short-term benefits and more on long-term commitments (Geyskens et al., 1999). As long-term relationships develop, cooperative behaviors flourish and create benefits, which can produce relational norms that govern relationships (Blau, 1986; Lambe et al., 2001). The relationship's ultimate success is achieved when actors receive benefits superior to other alternatives (Thibaut & Kelley, 1959).

Value Co-Creation Theory

Value co-creation is a theory used extensively in marketing and service management. Value co-creation provides a framework to explore how actors and organizations work together to create value. In both business-to-business (B2B) and business-to-consumer (B2C) relationships, value co-creation can help identify how value is created. Based on the work of Vargo and Lusch (2016), co-value is realized through exchanges between actors within business systems for mutual benefit. Within this theory, actors cannot deliver value alone; they can only create a value proposition (Vargo & Lusch, 2008).

Value co-creation happens when multiple actors within “dyadic relationships, multilateral networks, and ecosystems” engage in “practices that affect competition, strategy formation, and innovation” (Kohtamäki & Rajala, 2016, p. 4). Within this process, “value is actualized in the customer usage process rather than the supplier value chain” (Gummesson, 2007, p. 114), and all actors use their resources to participate in the value creation process (Vargo & Lusch, 2008).

Value co-production, a subprocess of value co-creation, is the process by which partners co-design the value proposition (Kohtamäki & Rajala, 2016). These processes are distinct because "value propositions are co-produced through purposeful collaborations among entities... value itself is created through use" (Kohtamäki & Rajala, 2016, p. 6). In short, value co-creation highlights the importance of collaboration and interaction in creating value and emphasizes that value is contextual, will be experienced differently by different consumers, is created through experiences, and ultimately evolves over time.

Relationship Marketing

Relationship marketing theory posits that relationships co-create value; it provides a concept for exploring the interactions within relationships and networks (Grönroos, 2004). At its core, relationship marketing analyzes how the relationship's characteristics influence its outcomes (Möller, 2013). Berry and Parasuraman (1991) view relationship marketing as a way to attract, develop, and maintain relationships. Within the theory, relationships are in a constant state of evolution "in which perceived satisfaction over each exchange episode is important" (Möller, 2013, p. 328), and actors are striving to realize mutual benefits in the partnership while avoiding costs (Möller, 2013).

Furthermore, Payne and Frow (2013) describe relationship marketing as "strategic management of relationships with all relevant stakeholders" (p. 4) and combine the use of technology through CRM to help explain the overall management of interactions. They argue that a comprehensive strategy that includes strategy development (vision and characteristics), value creation (value proposition, value assessment, and value co-creation), multi-channel integration (sales, direct marketing, and social media), information systems (CRM data repository), and performance assessment (outcomes, results, KPIs, value realization, and satisfaction) is necessary to realize the benefits associated with networks and relationships (Payne & Frow, 2013). According to Hunt et al. (2006), success in relationship marketing is influenced by eight factors:

1. Relational factors (trust, commitment, cooperation, keeping promises, communication)
2. Resource factors (complementary resources)
3. Competence factors (knowledge)
4. Internal marketing factors (internal buy-in and needs of employees)
5. Information technology factors (CRM, segmenting customers based on need)
6. Market offering factors (attributes that may be attractive to others)
7. Historical factors (valuing past and future interactions)
8. Public policy factors (socially beneficial exchange)

Understanding the various factors that influence the success of relationship marketing and how they impact relationships can lead to a strong competitive advantage (Hunt et al., 2006). The true value of relationship marketing is the value it creates between stakeholders and the framework it provides for understanding how to develop the appropriate relationship with each group so that a business can grow and thrive (Payne & Frow, 2013).

Conceptual Framework and Process Map

The terms B2B and B2C are often used in the literature surrounding relationships. To set the stage for this conceptual framework (see Figure 2), we want to clarify the term we use and why we chose it. Payne and Frow (2013) state, “Despite the distinction between B2C and B2B relationships, the two types have much in common, as both essentially involve relationships with individual people” (p. 56). However, because B2C is one-to-many and B2B involves multiple relationships on both sides, we frame it in a B2B context as our project involves multiple relationships.

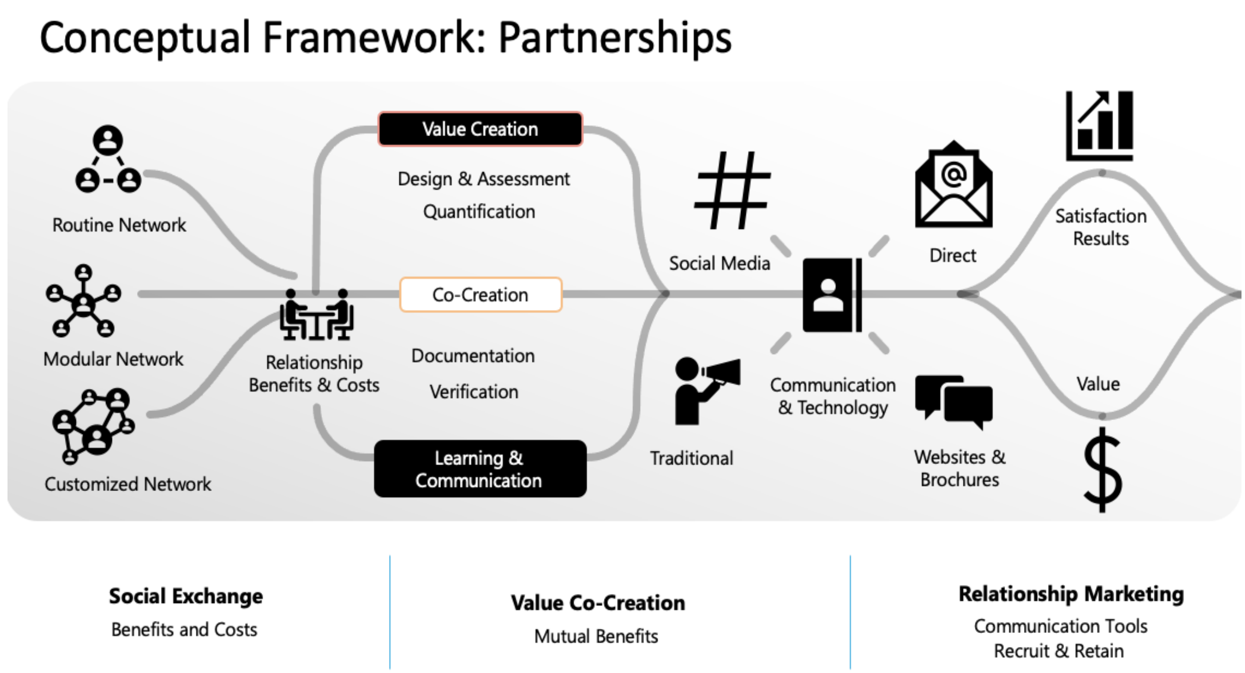
Our concept starts with the idea that partnerships are essentially relationships that exist within intentionally created networks (Möller, 2013) that are "goal-oriented and value-creating" (Matinheikki et al., 2017, p. 125). Members are a part of that network because they share underlying values, knowledge, and capabilities (Cross et al., 2005). Relationships are motivated by cooperation, strategic competition, and social responsibility and provide access to resources and opportunities to co-create value (Möller, 2013); hence, when individuals enter into relationships, according to social exchange theory, it is because they believe that the relationship will provide more benefits than costs (Blau, 1986; Homans, 1958). In order for the relationship to be successful, trust, commitment, cooperation, promises, shared values, and communication must be present (Hunt et al., 2006).

However, within the theory of social exchange, relationships are focused on the nature of the exchange, and neither the governance of the relationship nor the outcomes of the relationships play a significant role (Narayandas & Rangan, 2004). Research shows that relationships need structure to create partnerships (Eddy & Amey, 2014). Relationship marketing begins with the strategy development process by understanding the mission, vision, values, communication, and measurement required in the partnership (Payne & Frow, 2013). For relationships and partnerships to co-create value (Vargo & Lusch, 2016), partners must engage in a collaborative exchange that allows them to assess the resources each partner offers, weigh the costs and benefits of the partnership through value quantification, clarify the promise of value, document the value, demonstrate results, and implement feedback and assessment loops.

Throughout the lifecycle of the partnership, partners cycle through a strategy development process, a value creation process, and a multi-channel communication process, supported by an information management process (Payne & Frow, 2013) that helps build and retain partners in the relationship. A series of planned and unplanned communications (Grönroos, 2004) are disseminated through multiple communication channels and tools that are tracked in a data repository such as a CRM (Payne & Frow, 2013). Finally, through the value co-creation process, partners achieve relational outcomes and results that could not be achieved independently (Reypens et al., 2016) and will continue to cycle through that process until the partnership is ultimately dissolved.

Figure 2

Conceptual Framework



Project Questions

In collaboration with our partner organization and upon review of the literature and theoretical and conceptual frameworks, we created three project questions to inform our work. These project questions enable better understanding of the components of social exchange, co-value, and relationship marketing between educators, businesses, and MiSTEM.

1. What messages and communication tools are MiSTEM and K-12 educators using to convey the mutual benefits of partnerships between business and STEM educators?
2. What factors contribute to the costs and benefits of the partnership between K-12 educators, businesses, and MiSTEM?
3. What activities are MiSTEM and K-12 educators engaging in to recruit and retain their business partners?

Project Design and Methodology

This study used a qualitative approach to address the research questions. Purposeful sampling was employed in participant selection to ensure a comprehensive understanding of K-12 and business partnerships within Michigan's diverse communities. In the following section, we have provided an in-depth analysis of the data collection, analysis, and validation processes.

Organization Selection

This project focuses on understanding business and education partnerships. We are particularly interested in understanding the relationship dynamics and the resources needed to recruit and retain partners with diverse needs and expectations.

The MiSTEM Network was selected because of its desire to strengthen and expand business and education partnerships. Their work is intriguing because 16 regions across the state are working to integrate business and education to meet the unique and diverse needs of communities across Michigan. However, they need a uniform strategy for their approach. In addition, one of the unique challenges facing MiSTEM is that value realization occurs much later than in most partnerships because of their focus on the K-12 population. Given the geographic and resource challenges, the diverse motivations of partners, and the state's pressing needs, the organization provides a unique environment to study business and education partnerships.

Participant Selection and Sampling

We engaged in purposeful sampling for this project. We worked with our partner organization, MiSTEM, to accomplish two objectives concerning participant recruitment:

1. Target K-12 and business partners that received MiSTEM grant funding and encouraged new and innovative approaches to STEM education in Michigan K-12 classrooms.
2. Target K-12 and business partners in regions that represent the state's geographic, cultural, ethnic, and economic diversity.

This section outlines the sequence of activities for our sampling methodology. Our partner organization's primary contact presented us with 53 STEM education grant applications. We reviewed the projects, regions, and outcomes that each grant-funded project was trying to achieve and selected three projects—one from Region 1, one from Region 3, and one from Region 16. Our goal was to interview two educators and two business professionals from each of the three sample regions. Due to turnover and unavailability of participants, we had to contact a total of 19 individuals to obtain our sample of six educators and six business professionals.

The selected educators represented teachers, administrators, and educational consultants, while the business representatives served a diverse set of STEM industries and company sizes. We intentionally interviewed participants in regions that represent the state's cultural, geographic, and economic diversity. According to Patton (2002), the purpose of a stratified purposeful sample is to capture significant variations, although commonalities may emerge in the analysis. Our sampling strategy imbues our project with methodological rigor (Campbell et al., 2020). Table 1 provides detailed demographics and selection criteria.

Table 1

Participant Sampling and Selection

Region 3: Wayne County

It is the most populated county in Michigan, with over 1.7 million residents and an average household income of $52,830; 87.6% of residents possess a high school degree or higher, and racial-ethnic groups comprise 54% White, 38% Black, and 6.6% Hispanic (United States Census Bureau, 2022-b).

Region 1: Southwest Michigan Region

It has a total population of 783,308, an average household income of 58,381, and racial-ethnic groups comprising 82% White, 9.3% Black, and 6% Hispanic. Nearly half of the population of southwest Michigan has a high school diploma or a high school diploma, with some owning college degrees (Southwest Michigan First, 2022).

Region 16: Western Upper Peninsula

It involves a population of 171,832 residents, and an average household income of 55,163; 95.7% have a high school degree or higher, and racial-ethnic groups of 90% White, 2% Hispanic, and 1% Black (United States Census Bureau, 2022-a).

Role	Justification	Representation by Region
MiSTEM Regional Director	They were chosen because of their role as a connector between educators and businesses through MiSTEM. All possess significant	Regions 1, 3, and 16

	experience in an intermediate school district or regional educational service area.	
Educator	Educators were chosen because of their involvement in a MiSTEM grant; experience in high school, middle school, and elementary school settings; and educational consultant roles.	Region 1: Two Region 3: One Region 16: Three
Business	Business partners were chosen because of their direct involvement in MiSTEM grants and their connection to STEM careers.	Region 1: Two Region 3: Two Region 16: Two

The three regional directors interviewed in the focus group represented the same regions as the educators and business participants in our interviews to ensure consistency with our findings.

Data Collection

According to Tracy (2010), a qualitative study is considered rigorous when it incorporates extensive, suitable, and intricate procedures for data collection and analysis. Hence, we emailed participants prior to each interview, outlining the structure of the interview and addressing the issue of confidentiality (see Appendices A, B, and C). Additionally, we provided details on who would have access to the data, how the data would be stored, and the fact that the interviews would be recorded, transcribed, and subsequently disposed of after our project.

Interviews

For this study, we conducted 12 one-on-one interviews with educators and business representatives. Interviews are a foundational strategy for engaging in relationships with individuals in and across organizations (Edwards & Holland, 2013). We chose interviews as our primary data collection method because it would provide rich, contextualized descriptions of the participants' lived experiences as they relate to K-12 and business partnerships, and we wanted to understand how perceptions and experiences compared across participants. Understanding the similarities, differences, and nuances of expressed realities and experiences was essential. Research highlights the flexible nature of interviews as a qualitative method that enables one to explore thoughts, feelings, and ideas in more meaningful ways (Alamri, 2019). Our research interview protocol was jointly developed and refined with the support of our advisor to connect to our project questions and theoretical lenses, which include social exchange, value co-creation, and relationship marketing theories. During data collection, we worked to minimize bias and ensure accuracy by adhering to interview protocols and establishing dialogic engagement and meaning-making.

We scheduled and conducted interviews and focus group discussions, each lasting approximately one hour. The interviews and focus group discussions were scheduled and executed in November 2023. Each interview was conducted via Zoom to account for the various work schedules of the participants. K-12 educators and business partners were given nine questions to respond to in the one-on-one interview; seven of the nine questions included follow-up probes to analyze each person's unique perspective more effectively (see Appendix D).

As part of this process, we worked diligently to ensure that the interview was person-centered and adjusted to make the participants more comfortable. The interview questions focused on experiences, behaviors, opinions, knowledge, and background. Moreover, the interviews were semi-structured, which allowed for a more in-depth understanding of the participants' experiences (see Appendix D). In addition to structure, we accounted for the temporal nature of the participants. As researchers, we understand these interviews are a snapshot and must consider the interactions' subjective and non-neutral nature (Ravitch & Carl, 2021). We intentionally designed the interview process to address bias by dividing the interviews by focus type. The researcher with a background in K-12 education conducted the business interviews, and the researcher with a business background interviewed the K-12 educators.

We recorded the interviews on Zoom and then made high-quality transcripts of each interview and focus group discussion. Transcripts were stored on a password-protected device and destroyed following analysis. We acknowledged that responses would be contextualized and that we needed to be aware of our biases and judgments during the interview process. To ensure that responses were interpreted correctly, we recorded the Zoom interviews. Moreover, we did not take notes during the interview, which allowed us to stay fully engaged in the interview experience. For the focus group discussion, both researchers were present, and the questions were assigned so that one researcher would ask the first set of questions, followed by the second researcher with another set of questions. This process was intentionally designed to create clarity and structure for the participants and ensure their comfort.

Focus Group

In addition to one-on-one interviews, a focus group discussion with regional directors from three of the MiSTEM regions was conducted. We included a focus group because of its power as a qualitative method to engage in meaning-making with small groups of individuals and to promote understanding of essential issues (Kamberelis & Dimitriadis, 2020). The focus group provided a pathway to explore questions from various participants' perspectives, including their roles as MiSTEM employees and regional representatives. It created space to analyze everyday experiences from different viewpoints and build on one another's responses. Lastly, it created checks and balances to ensure a foundational understanding of cultural norms (Ravitch & Carl, 2021).

Document Analysis

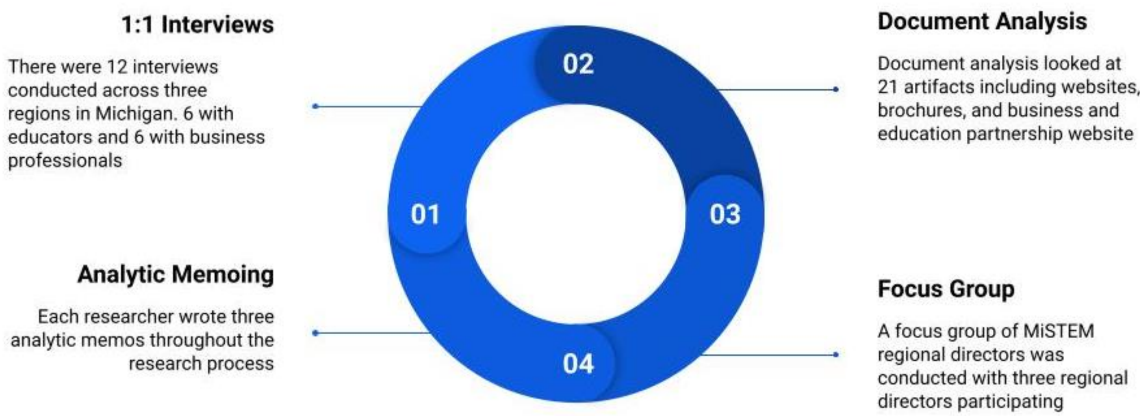
The final data collection method was document analysis. Document analysis was combined with interviews and the focus group as a means of triangulation (Bowen, 2009). Triangulation strengthens research findings and provides a check on researcher bias because the themes are present across methods (Bowen, 2009). Our document analysis allowed us to gain deeper insights and awareness of the assets mentioned during the focus group discussion, and additional data points were added to strengthen our findings and recommendations. Merriam and Tisdell (2015) note that document analysis may often be the best data source on a particular subject. The data helped provide context and history regarding how value was communicated and used by MiSTEM regional directors and community members. Our analysis (see Appendix I) considered 21 artifacts, which included brochures and websites that provided messaging on business and education partnerships. According to Merriam and Tisdell, a document analysis offers access to data that would otherwise take enormous effort and time to collect through other methods.

Analytic Memoing

To complement our data collection process, we engaged in the reflective practice of analytic memoing. Memo-writing increases the power of the analysis by being actively involved in data collection and connecting the research and theory (Charmaz, 2015). The memos provided space for us to capture, organize, and interpret thoughts as the process unfolded and the data were collected. Each researcher produced three analytic memos (see Appendices G and H) over the course of this project.

Figure 3

Data Collection Activities



Our data collection activities, illustrated in Figure 3, explore multiple methods and data sources in our qualitative design. Table 2 provides an overview of our data collection and analysis process.

Table 2

Data Collection and Analysis

Project Questions	Data Source	Data Collection Method(s)	Data Analysis Procedures
What are your project questions?	*What data are required to be able to answer this question? Specifically, who? what? where?*	*How will I acquire these data? Clarify whether it needs to be generated or where/how you will gain access to it.*	*How will I turn this data into evidence that answers this project question? Be specific.*
What messages and communication tools are MiSTEM and K-12 educators currently using to convey the mutual benefit of partnerships between business partners and STEM educators?	MiSTEM, K-12, and business perspectives on how the value proposition is currently being conveyed Regional MiSTEM and K-12 messages being created and disseminated Document analysis of websites and brochures that	Generated: Qualitative interviews with K-12, business, and MiSTEM partners and staff Generated: Focus groups with regional directors Existing data: Websites and marketing	Obtain data about current actions being taken by K-12 educators and MiSTEM staff, as well as information being communicated to business partners to understand how they are framing the mutual benefit of the partnership.

	discuss the benefits of the partnership	outreach material from MISTEM regional directors and K-12 educators	Use data from interviews to understand perspectives on the messages being conveyed to determine if adjustments or recommendations could be made. Use existing data analyzed in the document analysis process to illustrate the current state of conveyance of benefit of partnerships.
What factors contribute to the costs and benefits of the partnership between K-12, business, and MiSTEM?	Data from K-12 educators, business, and MiSTEM on benefits and costs	Generated: Qualitative interviews with K-12 educators, MiSTEM, and business partners	Use interview responses to uncover the benefits and costs of the various aspects of the partnership.
What activities are MiSTEM and K-12 educators engaging in to recruit and retain their business partners?	Data from MiSTEM, K-12, and business on corporate outreach activities (business plan, email, phone, meetings, etc.) and resources that are dedicated to recruitment and retention Data on the networks they are targeting: individual, school, regional, or corporate level Data on how the relationship is initiated and maintained: who initiates outreach, and how does communication in the partnership evolve?	Generated: Focus group with MISTEM. Generated: Interviews with K-12, business, and MiSTEM on current or past activities focused on recruitment and retention Existing data: Document analysis of brochures and websites to recruit business and educational partners.	Data will help determine the responses to outreach and which messages are resonating Data will help to understand their recruitment strategy and engagement practices and provide insight into what could be done differently. Identify if their current activities are beneficial in generating and retaining partners.

Data Analysis

Once the data were collected, we needed to organize them, engage them through multiple strategies, and develop ways to comprehend the data being presented in our research. Our analysis began with the audio recordings, video recordings, and transcripts. Each interview was recorded on Zoom and produced an audio and a video file that were used to develop software-generated verbatim transcripts for each interview. However, we recognize that no software can produce transcripts that are 100% verbatim. To preserve the accuracy of each interview, once generated, the transcripts and videos were downloaded into a password-protected cloud file and then uploaded into Atlas.ti. We then played the video while checking the transcript for accuracy. Since we recognize the importance of ensuring that the transcripts stay as authentic as possible to the original interview, we focused solely on the accuracy of the words transcribed rather than adjusting for clarity or speech patterns.

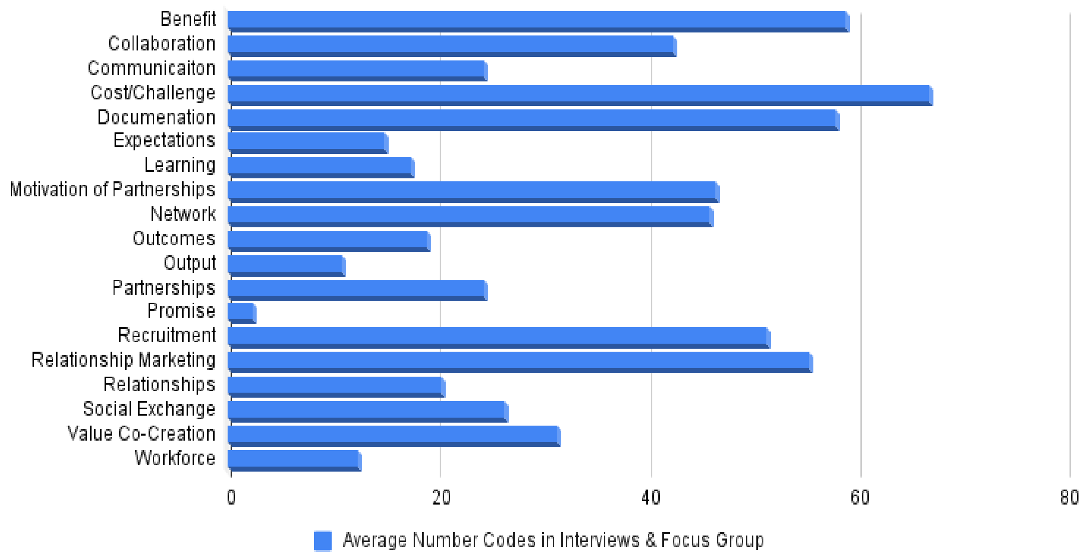
The next step in the process was to better understand the data through multiple readings. We conducted unstructured inductive readings, seeking themes and patterns. Next, we conducted group readings, analyzing the different groups interviewed and starting the inductive and deductive coding of the data. During this round of data analysis, we explicitly made connections between data and theory. Our three groups were educator interviews, business interviews, and the focus group with our MiSTEM regional directors. We then analyzed the brochures, websites, and other artifacts in our document analysis table (Appendix I). Throughout the project, we worked to identify themes, patterns, and connections with the data using grounded theory.

Once the multiple data readings were complete, deductive and inductive codes were developed to clarify definitions that should be used for consistency in the coding process (Bhattacharya, 2017). Deductive code definitions were informed by research on partnerships, social exchange theory, value co-creation theory, and relationship marketing theory (see Appendix E), while inductive codes emerged from the interviews, focus group discussions, and document data (see Appendix F). Upon completion of the codebook, we began the coding process.

The first stage of the coding process was to engage in open coding (Ravitch & Carl, 2021). Our thematic analysis used deductive and inductive coding (Braun & Clarke, 2006). We uploaded transcripts to the desktop version of Atlas.ti; reviewed each interview; highlighted text sections; and assigned them deductive, inductive, and/or multiple codes (see Figure 4). In addition to codes, we also explored connection strategies independently. We worked to achieve interrater consistency, conferring together, and agreeing on the shared meaning of the data and the codes. Hemmler et al. (2020) highlights that qualitative researchers can ensure coding consistency when they engage in a transparent and rigorous process. In alignment with this objective, we discussed the meaning of the codes and how they connect to the data. After reaching consensus, we continued coding the remaining transcripts and participated in dialogic engagement to develop a deeper understanding and mutually agree on interpreting the data (Ravitch & Carl, 2021). We recognize that a well-defined coding protocol creates the foundation for reliability and consistency (Burla et al., 2008).

Figure 4

Bar Chart of Average Deductive and Inductive Code Frequencies



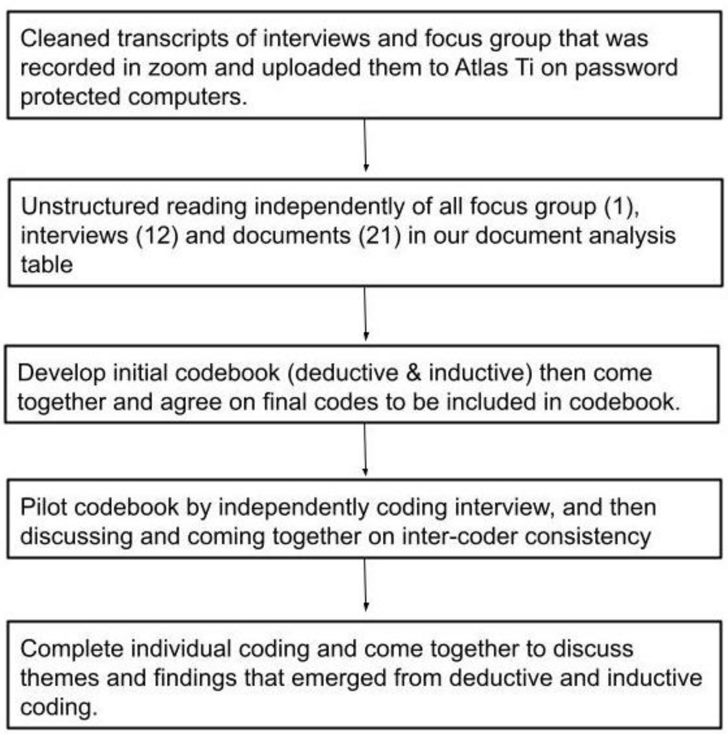
Throughout the 12 interviews, we actively participated in the coding process. We utilized a codebook with inductive codes, referencing it while reading transcripts, coding independently, and then collaborating to reach a consensus on major emerging themes. We coded all 12 interviews, ensuring consistency by following our agreed-upon definitions of key concepts outlined in the codebook. Furthermore, we coded the collected documents and artifacts to triangulate our findings.

For the focus group, we approached the coding process independently, relying on the codebook to analyze the sentiments and themes expressed during the discussions. The focus group questions were designed to extract important information relevant to our conceptual framework and project inquiries. Although the focus group interview was conducted jointly, the coding and analysis were performed individually. We then conferred together to discuss our findings and reach a consensus.

Similarly, for the document analysis table, we independently engaged in the coding process. This table consists of 21 artifacts (see Appendix I), and each document or media was assigned specific fields. After extracting data and examining the content from each source, we connected the document analysis data to our project questions and coded the documents using our inductive and deductive codes, as outlined in our qualitative codebook. By employing these three forms of qualitative methods and utilizing the same set of tools from our codebook, we aimed to produce comprehensive and reliable findings. Figure 5 outlines our method for maintaining consistency across data analysis methods.

Figure 5

Method of Coding Consistency



The final stage in the analysis process was to identify overlapping patterns. As we reviewed transcripts and documents, relationships between codes and themes emerged. We identified gaps in the data, tied themes to research questions, and organized the data to support the themes identified. The themes are discussed in more detail in the Findings section and relate to our specific research questions. Examining the data collected across focus groups, interviews, and document analysis allowed us to corroborate our findings, reducing the potential for bias that could exist in a single study method (Bowen, 2009).

We recognize that we are not neutral observers but individuals shaped by our experiences and perspectives. Our experiences of working in education and engaging with our partner influenced the research process and outcomes. We acknowledge our assumptions and have structured our process to promote the validity of this study, as outlined in our data collection and analysis sections. We mitigated bias and increased inter-coder consistency by independently interviewing research participants and coding, only conferring together to discuss and identify emerging themes. Our processes introduced essential checks and balances to engage in a thoughtful and reflexive research approach. To complement this process, we engaged in analytic memoing throughout the research project to improve the analysis by actively reflecting amidst data collection and intentionally reconnecting our work to our conceptual framework. Analytic memos support our reflexivity and help us understand the impact of our subjective experiences on data collection and interpretation (Primeau, 2003).

Findings

Research Question #1

What messages and communication tools are MiSTEM and K-12 educators using to convey the mutual benefit of partnerships between business and STEM educators?

Finding #1

There is inconsistency in how MiSTEM communicates the mutual benefits of business and education partnerships across the 16 regional websites.

MiSTEM has 16 regions, and each region maintains a website. While 14 out of the 16 regional website landing pages highlight the MiSTEM pillars, which include integrating business and education, only four provide users the ability to use the navigation on their main landing page to click on the words *for business, business resources, business & community,* or *business community* and link to a dedicated *business* (see Table 3) or *educator* (see Table 4) webpage. Region 8 was the only region that navigated to a webpage labeled *business partners*.

Table 3

Business Website Content

Region	Navigation Term	Dedicated *Business* Site Content
Region 3	"For Business"	For Business landing page: ▪ MiSTEM business education partnership brochure ▪ 7-minute MiSTEM career pipeline video ▪ Request for information form
Region 10	"Business Resources"	Business Resources landing page: ▪ Great Lakes newsletter ▪ Hyperlinks to past issues of an Employee Talent Pipeline newsletter ▪ Five stats on why you should care about building a STEM-based talent pipeline ▪ Four benefits for business ▪ A 25-minute video on internship opportunities

		▪ Link to a STEM pipeline blog with stories
Region 11	"Business and Community"	Business and Community landing page: ▪ Header: Business and education partnerships ▪ Content from the MiSTEM business and education partnership brochure outlines the types of partnerships: STEM resource, STEM supporter, and STEM professional, with examples of activities in each type of partnership.
Region 13	"Business and Community"	Business and Community landing page: ▪ An interactive chart that groups partnership activities by an organization's resources and time. ▪ The chart has three levels: high (investment), medium (investment), and entry-level (investment). ▪ Each activity has a short description with one of three action items: *Contact Us, Donate Today,* or *Learn More.* ▪ The Contact Us and Donate Today buttons link to a form to fill out. The Learn More button takes the user to additional sites that provide more information on the associated topic.
Region 8	"Business Partners"	Business Partners landing page: ▪ Three examples of business and education partnerships happening in the community ▪ Content from the MiSTEM business and education partnership brochure outlines the types of partnerships: STEM resource, STEM supporter, and STEM professional, with examples of activities in each type of partnership.

From an educator's perspective, six of the 16 MiSTEM regional websites allow website visitors to click on the words *For Teachers, Educator(s),* and *Education* to link to a dedicated site or additional resource links. However, none of the educator landing pages explicitly address messaging on the mutual benefits of business and education partnerships.

Table 4

Educator Website Content

Region	Navigation Term	Dedicated *Educator* Site Content
Region 3	"For Teachers"	For Teachers landing page: ▪ Graphic on business and education integration ▪ Two 50-second videos on the benefits of working with Region 3 ▪ Links to 13 teacher programs ▪ A link to the MiSTEM grants page ▪ Request for information form
Region 8	"Educators"	Educators drop-down menu: ▪ Career development resources ▪ Professional learning ▪ MiSTEM grants ▪ STEM resources ▪ West Michigan place-based learning (PBL)
Region 11	"Education"	Education landing page: ▪ A small paragraph about MiSTEM MiSTEM pillars ▪ Region 11 intermediate school districts (ISDs) ▪ MiSTEM regional map ▪ Newsletter sign-up form Education drop-down menu: ▪ Educational mini-grants ▪ Professional development ▪ Resources for educators
Region 13	"Educators"	Educators landing page: ▪ Educator opportunities ▪ Educator resources ▪ MiSTEM Network projects
Region 14	"Educators"	Educators drop-down menu: ▪ Career and technical education ▪ Computer science ▪ Externships ▪ Grants ▪ Mathematics ▪ Professional learning ▪ Science pages

Region 16	“Educator Resources”	Educator resources landing page: ▪ Descriptions and hyperlinks to 30 resources and activity kits for educator use

Finding #2

The MiSTEM brochures currently being used to convey messages regarding business and education partnerships provide information on MiSTEM's mission, vision, and network pillars, but the brochures do not clearly articulate the mutual benefits of business and education partnerships.

MiSTEM has produced two brochures titled *Transforming STEM Experiences Together*. One document is a two-page brochure, and the other is a tri-fold, but they depict the same content. Both documents explain the mission and vision of MiSTEM, the four pillars that drive MiSTEM work, and aspirational motivations (see Table 5)

Table 5

Brochure Aspirational Motivations

Document	Example Quote
Transforming STEM Experiences Together	“Encourage 21st century skills like critical thinking and problem solving.” “Foster career awareness, exploration and preparedness.” “Solve local issues at the local level.” “Contribute to the vitality of the community workforce and economy.”

They also include a “Did You Know” section with facts and statistics (see Table 6) about STEM.

Table 6

Brochure Facts and Statistics

Document	Example Quote
Transforming STEM Experiences Together	"Long term employment projections show that Michigan will see over 16,000 job openings in STEM each year." "Demand for workers in STEM is expected to grow at nearly twice the rate of other jobs."

However, the audience for the two brochures is unclear; more specifically, the content does not explicitly provide messages regarding the benefits of business and education partnerships.

The *3P Learning: Connecting Students to the World* brochure attempts to discuss place-based, project-based, and problem-based learning (see Table 7).

Table 7

Brochure Description of 3P Learning

Document	Example Quote
3P Learning Connecting Students to the World	"3P learning provides opportunities for students to learn in ways that are relevant to their lives. It is also a powerful way to connect K-12 schools and the businesses and communities they serve for the benefit of both."

The brochure outlines what 3P learning promotes and provides five examples of benefits for businesses. However, the mutual benefits of partnerships are not explicitly stated.

The MiSTEM *Business and Education Partnership Guide* provides five examples of benefits for businesses, seven benefits for schools and students, and three mutual benefits. However, based on the NSW Government Benefit Realization Framework (State of New South

Wales, 2018), benefits must be measurable and evidence-based. Hence, although the brochure highlights benefits that can be measured for businesses and schools, it does not clearly articulate mutual benefits that are measurable and evidence-based (see Table 8).

Table 8

Brochure Benefits by Audience

Document	Audience	Example Quote
Business and Education Partnership Guide	Business	"Increase brand recognition in your community."
	Educators	"Increase student achievement and engagement in STEM content areas."
	Mutual Benefits	"Contribute to the vitality of the community, the workforce and the economy."

In addition, in the MiSTEM *Business and Education Partnership Guide*, partners are segmented into three partnership types: STEM supporter, STEM professional, and STEM resource. However, the measurable benefits of partner participation are unclear, and partners may have difficulty understanding which partnership type is right for them based on what they value and the benefits they wish to realize (see Table 9).

Table 9

Brochure Partner Segmentation

Document	Partnership Type	Example Quote
Business and Education Partnership Guide	STEM Supporter	"Provide STEM resources, connections and support"
	STEM Professional	"Build community awareness, support and excitement for STEM occupations and industries"

	STEM Resource	“Help students and educators connect STEM knowledge and skills to STEM careers”

Finding #3

The communication tools used by MiSTEM and educators to convey the mutual benefit of partnerships are influenced by the relationship stage.

Dwyer et al. (1987) have stated that relationships develop over time and evolve in stages. The document analysis, interviews with educators, and focus group discussion with MiSTEM directors identified that when a potential partner is in the awareness stage of the relationship, communication tools such as brochures, videos, social media blogs, email, phone, and websites are utilized. The tools provide either a high-level overview or the talking points necessary to commence the conversation about the mutual benefits of partnership (see Table 10).

Table 10

Communication Tools Used in Early Stage of Partnership

Participant	Example Quote
Educator	“So a colleague of mine and I were interested in working together, and somebody forwarded me information about a grant.”
Business	“So I received an email. And then we said we would discuss it briefly. Then they sent a flyer.”

When asked about the tools they used to convey the mutual benefits of partnership, the MiSTEM directors specifically identified two MiSTEM brochures they use for awareness (see Table 11).

Table 11

Communication Tools Used in Early Stage to Convey Mutual Benefits

Participant	Example Quote
MiSTEM regional director	"We do have a brochure that's specific for educators to think about our work as a whole network, and it has those industry ties in there."
MiSTEM regional director	"We do have a pamphlet that is designed specifically for our industry partners to talk about kind of what they get and what we can offer."

Once the potential partners moved into the exploration stage, where costs and benefits were evaluated (Dwyer et al., 1987), face-to-face conversations, email, video conferencing, and phone calls were utilized. Across all interviews, these tools were recognized as helpful in streamlining communication. Once the partners moved into expansion (Dwyer et al., 1987) and were actively sharing resources and co-creating value, these continued to be the primary tools used in the communication process (see Table 12).

Table 12

Communication Tools Utilized in Middle Stages of Partnership

Participant	Example Quote
Educator	"There are Zoom meetings. There are meetings in person. Their meetings are usually at restaurants so they convince people to come by saying, Hey, we'll pay for your meal. Come on, let's have a face-to-face meeting. Talk about the project. So, the 5 required meetings a year usually take place at one of the local restaurants where they're paying for everything. But we also do a lot of emails. So, whenever we're going to go, do the project. So obviously, it's a year-long lot of stuff going on. But when we actually go to the beach to clean up, we contact them. Say, here, we're going to be there, and they usually send somebody out to kind of watch what we're doing. Observe, meet with the kids, talk to the kids. And so, they're watching what we're doing. We're emailing them. We are Zoom meeting with them. And we're meeting in person. And then they email us whenever the grants meet all the deadlines on the grants, they're emailing us,

	they're reminding us. So yeah, we kind of keep in contact and keep in contact in many different ways. We are welcome to call them at any time to discuss anything we want. And so, between phone calls, Zoom Meetings in person emails, we got it covered. The communication's very easy."
Business	"It (communication) was very much on a person-to-person level."

In the commitment (Dwyer et al., 1987) or dissolution stages of the partnership, newsletters, social media, blogs, and videos were incorporated to communicate the mutual benefits of the partnership to various stakeholders (see Table 13).

Table 13

Communication Tools Used in Later Stages of Partnership

Participant	Example Quote
Educator	"I do a lot of taking pictures of everything we do here, and I am communicating it every week. I send a weekly update to the parents, to the students and to the staff and I celebrate what we do on a weekly basis, so that A if it's not communicated, it never happened, and B for them to see what is actually going on, and to get that excitement. So, if you go on my blog post, you'll see my last one of my few last posts were the pictures of the bikes that kids assembling the bikes. Then I also send out a parent email that night. Because sometimes they'll not read over everything in your weekly update, but they'll see those pictures right away if that's the only thing the email is about. So, I'm over communicating to get the excitement out and when there's excitement and motivation the learning will come so it's all about finding a lot of hands-on things that I could do with the kids and then connected to essential standards that they're supposed to be working."
MiSTEM	"Anytime I can give positive publicity, like I'll put information on LinkedIn, they're doing something or they've connected, you know, we had Fox News come in and do an interview with one of our schools that has some business partners. There and you know I put them. The interview up on the you know my own personal LinkedIn page and so it's stuff like that."
Business	"They (the partner) created a video that they are going to use for marketing purposes."

It was clear from the one-on-one interviews and the focus group discussion that most businesses, educators, and MiSTEM regional directors utilized email as their primary method of communication, followed by face-to-face conversations, phone calls, and video conferencing tools (see Table 14). The absence of sufficient data and the inconsistency in data gathered from interviews and document analysis pertaining to social media, blogs, newsletters, and websites indicate that these channels are not utilized frequently or with a coherent strategy.

Table 14

Primary Communication Tools

Participant	Example Quote
Educator	"Most of it was email, we did have a zoom meeting once."
Educator	"So email was an important part of it, but in person contact also."
MiSTEM	"You extend an email… and then follow up with an email."
Business	"It was about 95% email. Then I would say we had a couple of zoom calls, and then the rest was phone conversations."

Finding # 4

When MiSTEM provided clear messages on the mutual benefits of partnership in the early stages of the relationship, business partners could navigate the relationship more successfully and clearly articulate the benefits of partnership at the end of the relationship.

For some business partners, in the early stages of the relationship, mutual benefits were implied but not specific. Lack of clarity resulted in business partners experiencing challenges in understanding and verbalizing the mutual benefits of a partnership at the end of the relationship. The data indicate this issue was more common when the educator, and not MiSTEM, initiated the partnership. However, when MiSTEM accepted the active role of a partnership connector and provided clear messages on mutual benefits in the early stages of the relationship, business partners could articulate the mutual benefits of partnerships more clearly at the end of the relationship (see Table 15).

Table 15

MiSTEM Initiated Partnership vs. Educator Initiated Partnership

Participant	Example Quote
Business *not initiated by MiSTEM	"The mutual benefits? I don't know if anything was. I have to think back. This was a while ago. I don't think, I don't know if anything was… It was implied that they would be getting this kind of hands-on experience."
Business *initiated by MiSTEM	"I had a great conversation, and he knew exactly what we were going for. He knew what we were trying to do, and I knew what he was trying to do with MiSTEM, and it was very clear to both parties what we were trying to accomplish."

MiSTEM aims to offer a six-step process on its place-based community partnership website to assist in partnership development. Step 1 emphasizes "clarifying the benefits for you and your partner" (MiSTEM Advisory Council & MiSTEM Network, n.d.-b). Nevertheless, the data reveal that educators, businesses, and MiSTEM do not employ any document or roadmap to facilitate this crucial step in the establishment of business and education partnerships.

Research Question #2

What factors contribute to the costs and benefits of the partnership between K-12 educators, businesses, and MiSTEM?

Finding #5

Partnerships with shared visions, goals, and values communicated measurable improvements and justified costs.

Hunt et al.'s (2006) work shows that individuals engage in relational exchange because the benefits outweigh the costs. When partners align goals and vision in a way that allows them to co-create value, they deliver mutual benefits that can have a significant impact (Elo et al., 2023). As shown in Table 16, each partner entered the partnership with a shared vision of engaging in STEM studies, providing exposure to skills that could pave the way to strong careers, inspiring experiential learning, and encouraging an active lifestyle. When evaluating the program's measurable improvements, the educator realized an improvement in student engagement.

Table 16

Partnership with Aligned Vision and Goals

Participant	Example Quote
Educator	"I wanted to make sure that we not only integrated the STEM/STEAM studies, but also integrated careers as much as possible… Considering that post covid, physical activity for students went down, we're focusing on that (physical activity) along with all the stem sciences."
Business	"We're not your traditional STEM program. So, typically we check a lot more boxes than just a classroom program because we get kids out on bikes. And we get them in a kind of a physical fitness space as well while we're learning."
Educator	"In the past I used to ask the students what's your favorite class and used to always be Physical Ed., which is great, but now it is STEM STEM STEM. The class where I build stuff. They can't remember the name but the class where I build stuff. Why, why do you like it? Because it's fun? Well, it's fun. And you're actually doing engineering activities. So, and you're doing a lot of math calculation. And you're doing a lot of learning. So, I'm excited that they're excited. It's gonna make all our jobs easier. And it's gonna be better for the community as a whole, I believe."

Thus, when the educator was questioned about the partnership's costs, they stated that the costs were justified because the benefits received were satisfactory. Moreover, the business partner indicated that the costs were minimal compared to the overall benefit for the students and society (see Table 17).

Table 17

Partnership Benefits Outweigh Costs

Participant	Example Quote
Educator	"So there are a lot of purchases here and there that do add up. But I'm very happy putting our funds to use that way."
Business	"It's not about charging more. It's not about making more. It's really about getting this in front of kids, right? And the opportunity to get kids not only really kind of engaged around the STEM, but around bicycling and fitness and mobility and exploration, discovery, all those things that come with the bicycle right. And our goal is that not only we teach kids the aspects of STEM through bicycle, but they may go home. And what they're, you know, talking to their mom. And dad is, hey? I'd love to have a bike, right? Get kids basically back on 2 wheels that a lot of us in our youth experience, a lot of those things that kids aren't experiencing today. Right? And so, it's full. It's full circle for us…. And you know, that's really the goal is to influence kids' learning opportunities through a bicycle."

Finding #6

The costs and benefits of business and education partnerships can be significantly influenced by the availability and allocation of resources, including time and staff support, as well as investment in human resources.

When asked to assess the cost of the partnership, the participants identified time and administrative support as the most challenging resources to secure. Notably, some partnerships used a consultant or broker to help with partnership activities such as designing curriculum, structuring the partnership, managing challenges, and reinforcing benefits (Lee et al., 2016). When additional staff, consultants, and pre-existing or long-term relationships were leveraged, partners experienced fewer costs and more benefits due to the additional support (see Table 18).

Table 18

Consultants as Educator Resources

Participant	Example Quote
Educator/ Consultant	"So when I (consultant) write lessons or design field trips, I know what standards they (educators) have to cover and how I can fit this directly into what they are already doing, so that's not something extra they have to do. But it is something embedded in what they already need to cover for their students. They (businesses) don't know the curriculum well enough to know how they can fit stuff in, whereas for us, because I'm the one who writes and revises the curriculum, I know how to cover the things the teachers don't want to cover."
Educator	"He (retired teacher/consultant) set it up all around our school for us that we already have, and he kind of created the mutual benefits for the students. He did all the communication, you know, because we have to actually write it up to show how our students are going to benefit when we do the grant the mini grants, and so they have a format they send us. And a lot of the questions are involving, well, how is this going to help your students. So, I guess that communication was all already built and in place when I took over."

Some businesses indicated that the company assigned staff to the partnership; however, others specified that employees participate on a volunteer basis and they needed more staff to help with the commitments (see Table 19).

Table 19

Business Resources and Needs

Participant	Example Quote
Business	"She's been (in her company role) doing it for 20 or 25 years, and she actively nurtures those relationships. She goes to conferences, and she speaks and those sorts of things. I know a person who used to be at Autodesk doing it. But she actually left Autodesk and went to Purdue. So, I don't know who's doing it at the auto desk."
Business	"There's a lot of other groups that I partner with as well. So, I frequently have requests, you know, for my time, and to go to classrooms, and sometimes it's not as easy as a yes, just because I also, you know, I have family and kids and obligations. So, when it's like after hours, if it doesn't work with kids' activities.

	So sometimes it's harder to get there. Just the planning of, you know, when I could make my time available.”
Business	“In general, we just need some interns or part-time staff that can assist.”

Challenges surrounding time were factored into several aspects of the partnership. Time invested toward engaging in partnership, attending MiSTEM training, building curriculum, and incorporating field trips into a packed classroom instruction schedule, while convincing employees to volunteer time out of the office or take a vacation day to participate in unpaid MiSTEM-related activities was noted as a challenge and cost of partnership (see Table 20).

Table 20

Costs of Partnership

Participant	Example Quote
Educator/ Consultant	“Ok, so that’s (MiSTEM training) a little bit of a challenge, mainly, you know, having to take the time out of my own personal time to attend those trainings without necessarily compensation. So sometimes our MiSTEM Network will actually work on getting a stipend for those training we have had in the past. Where we put our hours that we did, and then we get a check at the end of the year, or whatever. For training we attended it. That can be helpful because it does. Take away family time and, you know, personal time.”
Educator	“There were three (MiSTEM) sessions you had to attend that were for a couple of hours. All the stuff is really, really great, but it's just very lengthy. So, I remember that one session was like a 2.5 hour meeting and I'm a building administrator. So, for that one meeting I actually supervise a football game while on my zoom outside, and I forgot my microphone was on, and I'm trying to get kids out of the parking lot before they hit. So, it wasn't ideal.”
Educator	“I guess our biggest problem that we arise is that we’ve got to be aware of everybody's time. I'm a math teacher. I have to get through the curriculum, which is impossible to get through as it is. So, if we spend 10 days at the beach, or the school forest, or outside of school, that means I have 10 days not teaching math in my classroom. And we've tried to make sure it involves math, it involves language arts, it involves computers, it involves science, it involves all the core curriculums. But again, it's, I would say time is our biggest issue and a teacher’s biggest complaint is I can't finish my curriculum. Now we're

	trying to pile on more and so that's something but that always will be a problem, no matter what.”
Business	“Requests come in, we take a look at the emails and determine if we have anyone available that can volunteer or support it. But it's not a set role for any single person. It's just as things come up. We have a couple of engineering interns that might volunteer for it.”

Finding #7

When businesses and educators do not create a mutually agreed-upon structure where roles, responsibilities, expectations, goals, and outcomes are clearly defined, inequities in the execution of partnership activities can cause a significant strain on the partnership.

Morris et al. (2021) emphasize that identifying clear partnership goals is essential for success. Moreover, Gillen et al. (2021) indicate that clear communication channels and equitable distribution of work can help nurture strong relationships and partnerships. However, we found that not all partnerships had clearly defined expectations, which contributed to the costs and challenges (see Table 21).

Table 21

Partnership Strains

Participant	Example Quote
Business	“Obviously, you want it to be a partnership, but it's what I like. I guess. I just wish that I had the time to devote to it. But I don't feel like I should be like it should be a balance between the partners, I guess. It wasn't terrible, but it was. I know there were moments where I was like, okay, I gotta... where I felt like I was managing the whole thing as opposed to it, being a little bit more balanced. That makes sense, I hope. I think it's difficult. I know a lot of teachers are overwhelmed and rightfully so, and they do so much. But on field trips the teachers kinda just wanna check out. They're like, Okay, great. You're here, you're gonna take over. We're gonna go like, look at our cell phones over here for a while, or we go like wander off into the garden. So, I guess just having folks that are more willing to treat it like a partnership instead of like great I don't have to do my job right now.

	You're gonna take over that kind of thing. not to say that that happens all the time. But there are. There are definitely moments where I felt that. And I'm like, okay."
Educator	"So I feel like I have been taking all the lead and all the action."
Educator/ Consultant	"So there is one teacher that would call and say, can we bring the whole school out for a field trip next Friday? She did that like four or five times. You would think maybe you would know ahead of time."

The place-based community partnership website encourages partners in Step 5 of 6 to "host one or more planning meetings with partners and work out the understanding of what each entity will be contributing to assist in partnership development" (MiSTEM Advisory Council & MiSTEM Network, n.d.-b). However, our data do not support that mutually agreed-upon roles, responsibilities, and outcomes have been clarified for all partnerships.

Research Question #3

What activities are MiSTEM and K-12 engaging in to recruit and retain their business partners?

Finding #8:

MiSTEM and educators are informally recruiting potential business partners through strong and weak ties. However, MiSTEM lacks a targeted recruitment and retention strategy, measurable goals, and a CRM system to support recruitment and retention efforts.

Möller and Svahn (2006) highlight that both strong and weak ties are needed to sustain diversity and stability in a network. Members are often selected because they have resources complementary to the network (Matinheikki et al., 2017). The data reveal that several of the partnerships involved in this study resulted from personal connections (see Table 22). In other instances, individuals had a weak relationship, leading to a partnership connection.

Table 22

Traditional Partnerships

Participant	Example Quote
Business	"I've known her for years… There is not anything she needs to do to actively recruit me."
Business	"We've just kind of been crossing paths back and forth with different initiatives."
Educator	"She has kids who play soccer and I referee soccer."

It is clear that the network is leveraging relationships to create traditional partnerships (Eddy & Amey, 2014) that work to solve a specific need; however, strategic partnerships (Eddy & Amey, 2014) are proving more challenging to develop due to a lack of strategy and resources like a CRM system (see Table 23), which can be used to segment populations, customize communication, record exchanges, and sustain long-term relationships (Fraccastoro et al., 2021).

Table 23

Strategy and Technology Challenges

Participant	Example Quote
MiSTEM	"But in general, I feel a lot of times….I'm supposed to just figure it out on my own. I don't feel like there are unified strategies that we are all trying to do or required to do… You can respond to your local need, but also, it's like I have to go and ask him about his strategy and, you know, like we don't have a lot of time to share those strategies together."
MiSTEM	"I had like a part-time person… but she would have one-on-one conversations with businesses and then connect them to one teacher and it's like there's 64 school districts and one person is never gonna be able to have enough things. So how do we create a system that helps with that? So, like a database that each region could help have you know some connections or something. Like, I think we need to have, like, a more systematic approach to it rather than just letting everything be organic."

MiSTEM	“So, can we put those in a bank somewhere so that we can know what it really looks like to have these partnerships? Because each region has different things, but I think that we could get some commonality because right now it's kind of up to each region to figure it out on their own. And that's a lot of work especially when you're thinking in my region, there's eight different counties that we're trying to organize. And that gets very complicated.”
MiSTEM	“I think we could be tighter in alignment and think about the regional connectors from MDC and LEO that every region should be connecting with. I think we could strengthen those partnerships so that we'd be going to those events and like lifting that up. I also think that we could tighten our relationship with our legislators and help like they interface with these people all the time, and so they could be helping us to connect with people in a different way. That I think we often feel. Like, we're not supposed to talk to them. So just defining, you know, who we should be talking about to and whose responsibility it is.”

Recommendations

Research Question #1

What messages and communication tools are MiSTEM and K-12 educators using to convey the mutual benefit of partnerships between business and STEM educators?

- **Finding #1:** *There is inconsistency in how MiSTEM communicates the mutual benefits of business and education partnerships across the 16 regional websites.*
- **Recommendation #1:** *Create consistency in how MiSTEM communicates the mutual benefits of business and education partnerships across the 16 regional websites.*

Communication is one of the most effective ways to build relationships (Hung & Lin, 2013; Sashi, 2021) and the process by which information is shared should be consistently evaluated (Mohr & Spekman, 1994). Because relationships develop in stages (Dwyer et al., 1987), organizations must strive to ensure potential partners have relevant, timely, and accurate information (Mohr & Spekman, 1994) that helps them move from stage to stage. Currently, MiSTEM’s 16 regional websites are inconsistent in how they communicate the mutual benefits of partnerships. Moreover, MiSTEM offices being located in geographically diverse regions across the state further complicates the situation. Research reveals that when geographic diversity is a factor, digital communication is more frequently used to obtain information necessary to make decisions (Fraccastoro et al., 2021; Sashi, 2021). Thus, consistency in how information is disseminated across regional websites is essential to ensuring proper dissemination of information on business and education partnerships.

To remedy this issue, we recommend that MiSTEM take proactive measures to streamline information related to business and education partnerships across all 16 websites. Should MiSTEM prefer to continue using the current navigation to segment partners by keeping business and educators on separate navigation tabs, we recommend using the terms "Businesses" and "Educators" across all websites. In addition, once a user navigates to the separate landing pages, similar information and messages about business and education partnerships should be prominently displayed, along with a request for information form or contact information for the regional director. However, while applying separate navigation tabs across all 16 websites creates consistency, we believe that business and education partnerships could be given greater prominence. A new tab should be created in the navigation, labeled “Business and Education Partnerships,” expounding the mutual benefits of integrating business and education in partnerships and providing detailed information for each stakeholder. We also recommend that hyperlinks be placed on the individual educator and business pages with a call to action, such as "Learn More About Business and Education Partnerships," for easy access to the new landing page should they not navigate directly to the page.

- **Finding #2:** *The MiSTEM brochures currently being used to convey messages regarding business and education partnerships provide information on MiSTEM's mission, vision,* *and network pillars, but the brochures do not clearly articulate the mutual benefits of business and education partnerships.*

- **Recommendation #2:** *Create a comprehensive marketing tool that clearly articulates the value of integrating business and education, the mutual benefits of business and education partnerships, and the promise in exchange that can be accessed on the website or in print.*

Hung and Lin (2013) identify that relationships are unlikely to form if communication does not address the "wants, issues, inputs, and priorities" (p. 1229) of partners. Ensuring communication tools are targeted to specific needs (Kim & Kumar, 2018), are "relational and collective" (Haumann et al., 2015, p. 29), and highlight the value, benefits, costs, and promise in exchange can encourage collaboration and reduce perceived risk (Haumann et al., 2015). Currently, MiSTEM possesses several brochures that are used rarely and do not clearly articulate the mutual benefits of business and education partnerships. We thus recommend designing and creating a more robust marketing tool around the MiSTEM pillar of "integrating business and education." The brochure should align with Michigan's "Make it in Michigan Plan;" focus on people, projects, and places (Executive Office of the Governor Communications Division, 2023); and provide insight into MiSTEM's work. Moreover, the brochure should provide testimonials and examples of project, problem, and place-based experiences. Finally, an overview should be provided of how educators and businesses can form partnerships based on their financial and economic resources and social and relational values (Kim & Kumar, 2018).

MiSTEM uses STEM supporter, STEM professional, and STEM resource to segment business partners by service levels in their current collateral. We argue that the current segments could be more reflective of the partners' work, financial resources, and relational values. In other words, the segments could be more reflective of the service level and the benefits they seek. Hence, we recommend using STEM supporter for transactional or financial support, STEM mentor for career engagement, and STEM instructor for learning-based engagement. K-12 educators should also be added as a fourth category to demonstrate the mutual benefits of partnership and the promise in exchange.

- **Finding #3:** *The communication tools used by MiSTEM and educators to convey the mutual benefit of partnerships are influenced by the relationship stage.*
- **Recommendation #3:** *Create a multi-channel strategy for MiSTEM to expand the use of underutilized communication tools that can be used to enhance communication in the early and advanced stages of the relationship/partnership.*

We learned from the one-on-one interviews and focus group discussions that most business partners, educators, and MiSTEM regional directors primarily use face-to-face conversations, phone calls, emails, and video conferencing tools through all relationship stages, while websites, social media, blogs, and newsletters are used less frequently. Although face-to-face conversations, phone calls, email, and video conferencing are successful in building rapport (Ahearne et al., 2022) and sharing information (McFarland et al., 2006; Singh et al., 2020), they are time-consuming and best used when the relationship is in the exploration and expansion stages (Dwyer et al., 1987). As the partnership moves through the various relationship stages, digital communication creates efficiency in exchange (Fraccastoro et al., 2021; Sashi, 2021; Singh et al., 2020), and social media can help reach a wider audience (Fraccastoro et al., 2021).

To secure these advantages, we recommend creating a multi-channel strategy that carefully considers the messaging and communication tools most relevant to partners at the various stages of the relationship. In addition, MiSTEM should assist regional directors by creating content that can be easily disseminated to partners via social media, blogs, websites, and newsletters in the awareness or loyalty stage (Dwyer et al., 1987), which could prove helpful in maintaining communication consistency and promoting partner engagement.

- **Finding #4:** *When MiSTEM provided clear messages on the mutual benefits of partnership in the early stages of the relationship, business partners could navigate the relationship more successfully and clearly articulate the benefits of partnership at the end of the relationship.*
- **Recommendation #4:** *Regardless of who initiates the partnership, MiSTEM should play a proactive role in serving as a connector providing clear messages on the mutual benefits of partnership to both the educator and business partner in the early stages of the relationship.*

We realize that the decision to collaborate does not automatically guarantee success. A strong understanding of partner motivations and expectations expressed through dialogue is essential (Elo et al., 2023). More specifically, Lee et al. (2016) found that organizations that developed a rationale for participating in partnerships perceived more substantial benefits than those that did not. Based on the literature and the data presented in this study, we recommend that MiSTEM formalize a connector role in the educator-business partnership. As part of the process, MiSTEM would be responsible for clarifying the mutual benefits of the partnership and ensuring they have been communicated to both partners in the early stages of the relationship. If partners keep their promises, the trust developed can lead to inter-organizational cooperation, commitment, and long-term satisfaction (Narayandas & Rangan, 2004; Sashi, 2012), which may yield strong relational benefits for MiSTEM.

Research Question #2

What factors contribute to the costs and benefits of the partnership between K-12 educators, businesses, and MiSTEM?

- **Finding #5:** *Partnerships with shared visions, goals, and values communicated measurable improvements and justified costs.*
- **Recommendation #5:** *MiSTEM should connect educators and business partners based on their underlying values, knowledge, level of determination, and capabilities.*

The literature reveals that a business network is an exchange system where actors are tied through business relationships that share an interdependency (Anderson et al., 1994). Within this context, networks are tied together through actors, resources, and activities that engage in resource and social exchange to achieve relational and economic benefits (Hakansson & Ford, 2002; Möller, 2013). Moreover, members are often excluded if their resources do not align and are included when they have complementary resources (Hitt et al., 2000; Matinheikki et al., 2017). Cross et al. (2005) emphasize that networks can be classified based on their underlying values, knowledge, level of determination, and capabilities (Cross et al., 2005).

We recommend that MiSTEM take steps to segment its partners and intentionally pair them based on their values, vision, goals, and motivation to achieve mutual benefits and reduce costs. Using Cross et al.'s (2005) classifications, we recommend segmenting potential partners into the following three categories as part of a business operations process to ensure that the relevant partners are matched in the future.

1. Routine Partners
    a. Values: Consistent response to a known problem
    b. Cost: Minimal or fixed investment
    c. Structure: Defined with routine decisions

   d. Examples: Internships, externship, career fairs

2. Modular Partners
   a. Values: Delivering sequence of expertise
   b. Cost: Modest investment in tools and technology
   c. Structure: Cross-functional and role-based
   d. Examples: Plug and play curriculum or projects and pre-designed programs
3. Customized Partners
   a. Values: New product development and innovation
   b. Cost: High investment of resources and social capital
   c. Structure: Fluid decision-making
   d. Examples: Customized curriculum and work-based experiences

- **Finding #6:** *The costs and benefits of business and education partnerships can be significantly influenced by the availability and allocation of resources, including time and staff support.*
- **Recommendation #6:** *MiSTEM should consider hiring additional resources or leveraging current resources more effectively to reduce costs and enhance the benefits of partnership.*

In alignment with the literature, our study supports that time and administrative support are two of the most significant costs in business and education partnerships (Gillen et al., 2021). In addition, the data and research both support that partnerships that include a broker or specifically assigned staff have greater success in reinforcing benefits, managing challenges, and meeting the objectives and goals of the partnership (Lee et al., 2016). Understanding that human resources can reduce costs and enhance benefits, we recommend that MiSTEM consider hiring additional staff or leveraging current resources more effectively.

If MiSTEM possesses the funding, we recommend hiring 3–4 territory managers that would serve 4–5 MiSTEM regions. In this role, they would primarily be responsible for developing relationships resulting in business and educator partnerships, acting as MiSTEM connectors to ensure the vision, goals, and expectations are clear and mutual benefits are realized. However, should hiring be financially challenging, we recommend utilizing current resources more effectively. For example, one of the MiSTEM grant projects worked with Pierce Cedar Creek Institute's education director. Although not a teacher in a Michigan school, the education director can create a curriculum for a project that aligns with classroom lessons. In this instance, the education director eliminates a burden on the educators, who would otherwise have to manage the curriculum aspects of the project along with their day-to-day responsibilities. The Calumet Township MiSTEM grant recipient utilized the services of a retired teacher to facilitate partnership work and assist in advancing the educator-business objectives. Lastly, there are 57 intermediate school districts (ISDs), regional educational service agencies (RESAs), and regional educational service districts (RESDs) in Michigan (Michigan Alliance for Families, 2022) that could be leveraged for obtaining additional support, increasing benefits, and reducing the costs of partnerships.

- **Finding #7:** *When businesses and educators do not create a mutually agreed-upon structure where roles, responsibilities, expectations, goals, and outcomes are clearly defined, inequities in the execution of partnership activities can cause a significant strain on the partnership.*

- **Recommendation #7:** *To avoid unnecessary partnership costs, we recommend implementing a partnership charter that clarifies roles and manages the partners' expectations.*

Partnerships require a shared purpose and goal among stakeholders (Sumberg, 2000; Watters & Diezmann, 2013). Developing strong partnerships necessitates investing in identifying clear goals (Morris et al., 2021), developing strong communication channels, and distributing work equitably (Gillen et al., 2021). According to the Council for Corporate and School Partnerships (2002), partners require clearly identified objectives, roles, responsibilities, expectations, resources, and timelines, as well as mutually defined benefits and costs. For both businesses and educators, finding the time to meet, create, engage, communicate, and teach can be challenging (Deeter-Schmelz, 2015; Gillen et al., 2021; Morris et al., 2021), and a lack of understanding about how each partner measures success can cause significant strain (Lee et al., 2016). In order to help set expectations for the partnership and clarify roles and responsibilities, we recommend implementing a partnership charter or guide.

This recommendation is inspired by our data, the literature, and the six-step process to guide partnerships located on MiSTEM's place-based community partnership website (MiSTEM Advisory Council & MiSTEM Network, n.d.-b). We recommend expanding this guide to be a partnership charter that outlines a partnership's shared:

1. Purpose
2. Mission
3. Values
4. Goals
5. Objectives
6. Benefits
7. Costs
8. Roles
9. Responsibilities
10. Communication strategy

11. Resources needed 12. Timeline for activities

We further recommend that MiSTEM operationalize the definitions of each term to establish consistency. The regional directors can then facilitate the completion of this form with each business and educator partnership and provide periodic check-ins to ensure that the partners follow through on the responsibilities assigned.

Research Question **#3**

What activities are MiSTEM and K-12 engaging in to recruit and retain their business partners?

- **Finding #8:** *MiSTEM and educators are informally recruiting potential business partners through strong and weak ties. However, MiSTEM lacks a targeted recruitment and retention strategy, measurable goals, and a CRM system to support recruitment and retention efforts.*
- **Recommendation #8:** *Create a comprehensive strategy for engagement and invest in building a CRM system that can support MiSTEM and its regional directors with the technical support necessary to recruit and retain business partners.*
  **This recommendation will incorporate previous recommendations in an effort to illustrate the comprehensive strategy that is needed to recruit and retain business partners.*

According to Payne and Frow (2013), strategic customer engagement requires both a strategy (relationship marketing) and a tool (CRM system) to manage the relationships of all relevant stakeholders efficiently and effectively. They argue that a comprehensive strategy that includes strategy development (vision and characteristics), value creation (value proposition, value assessment, and value co-creation), multi-channel integration (sales, direct marketing, and social media), information systems (CRM data repository), and performance assessment (outcomes, results, KPI’s, value realization, and satisfaction) is necessary to realize the benefits associated with networks and relationships (Payne & Frow, 2013).

We argue that MiSTEM has a strong business purpose, vision, and values but needs to refine its customer strategy. In other words, MiSTEM needs to specify the types of partners they want to attract and ensure they understand what makes each unique. We have provided recommendations on how MiSTEM could segment its business partners in Recommendations #2 and #5:

1. Segmentation by service and benefits: Attracting businesses by service levels and the benefits they seek (Recommendation #2)
    a. STEM supporter, STEM mentor, STEM instructor, K-12 educator
2. Segmentation by value sought: How businesses are motivated (Recommendation #5)
    a. Routine partner, modular partner, customized partner

Our data show that MiSTEM has a compelling value proposition for business and education partnerships focusing on building STEM skills for Michigan's future workforce. Data from this study demonstrate that MiSTEM's regional directors are influential at verbally presenting the value to partners; however, per Recommendations #1 and #2, MiSTEM needs to refine and build additional tools to effectively communicate the value proposition to the partners. Once partnerships are established, MiSTEM should follow Recommendation #7, which explains the efforts required to clarify and assess value and value co-creation activities with the partners directly.

Recommendation #3 indicates that MiSTEM is struggling to effectively execute a multi-channel strategy that involves utilizing various communication tools that can be crafted for each segment based on the partners' preferences and delivered via the most appropriate channel based on their relationship stage (Dwyer et al., 1987). MiSTEM's investment in crafting a strategy and content to support it allows its regional directors to focus not only on the recruitment of partners but also on their retention, which is essential to successfully executing their vision.

MiSTEM regional directors emphasized in our study that there was a strong need for a database to store information. Technology such as CRM systems can be critical in collecting, organizing, sharing, and tracking information (Payne & Frow, 2013). Given MiSTEM's geographic diversity, our data show a need for a system that allows sharing, collaboration, and insight across the 16 MiSTEM regions. However, we emphasize that this system must be relational; it should not simply be a warehouse of information but a tool that supports relationship management, campaign management, inbound and outbound marketing, the customer journey, measurement of business activities, and performance tracking.

As the final piece of the strategic customer engagement strategy, MiSTEM needs to more clearly define, track, and disseminate outcomes, results, KPIs, value realization, and satisfaction related to business and education partnerships. Both businesses and educators need organizational support to participate in these partnerships (Gillen et al., 2021), and providing clear, measurable, and concise outcomes could reduce barriers to recruiting and retaining partners (Council for Corporate and School Partnerships, 2002).

Discussion and Conclusion

Throughout this capstone project, we worked with the MiSTEM Network to explore education and business partnerships. We specifically examined the messaging and communication tools currently being used to convey the mutual benefit of partnerships; the factors contributing to the costs and benefits of partnerships between K–12 educators, businesses, and the MiSTEM Network; and the activities that the MiSTEM Network and K–12 partners are engaging in to recruit and retain business partners.

Our research explored the experiences of 12 individuals across Michigan who are involved in STEM education partnerships. The data presented in our findings and recommendations sections elevates these voices and examines current MiSTEM messaging and operations to optimize the execution of Pillar 3, "integrating business and education." Research findings emphasize the need for a consistent value proposition across marketing and communication channels, advocate for improved structure, value alignment, resource support for partners, and encourage implementing strategic and technical support for recruitment and retention activities. Our work clarifies the perspectives of current partners in business and education as well as regional directors regarding the state of business and education partnerships catalyzed by the MiSTEM Network and supports MiSTEM's efforts to "embrace learning experiences beyond the physical classroom" (MiSTEM Advisory Council, 2022, p. 10).

Areas of Further Inquiry

Considering the findings and recommendations from our capstone study and the limitations of our design and scope of work, we recommended the following three areas of future inquiry:

- Further exploration into current activities and future action MiSTEM can take to retain business and education partnerships across the 16 MiSTEM regions
- Further investigation into the development of a strategic CRM system
- Extended examination of the 16 MiSTEM regions' websites

Our research specifically asked participants about MiSTEM and K–12 educators' activities for recruiting and retaining business partners. However, our third project question combined recruitment and retention into one question rather than two. As a result, most of our participants focused their responses on recruitment rather than retention. According to Dwyer et al. (1987), relationships take time to develop and evolve through various stages. We recognize that partner retention activities are essential for long-term engagement (Sashi, 2012). Since our data did not provide sufficient insight into those activities, we propose further inquiry.

We recognize that implementing a CRM system would be a significant undertaking for MiSTEM. According to Payne and Frow (2013), it is essential to comprehensively evaluate business operations, analytics needed, and collaboration required when developing a CRM. Thus, we recommend that MiSTEM perform a thorough analysis of current operations and clarify future needs to identify an efficient and effective system to support MiSTEM's efforts. Moreover, MiSTEM should conduct extensive research to select the ideal software for implementation.

Our project investigated the communication tools that MiSTEM and K–12 educators use to convey the mutual benefits of partnerships between businesses and STEM educators. The analysis involved examining the main landing pages of all 16 regions within the MiSTEM Network. However, determining the best way to enhance MiSTEM's digital presence is beyond the scope of our project. Therefore, it would be highly beneficial to involve a user experience (UX) designer who can analyze MiSTEM's digital presence across regions and explore how consistency and flexibility can support regional directors and the statewide MiSTEM Network in achieving better engagement. The UX designer can conduct surveys, usability testing, and user interviews to identify areas for improvement and help MiSTEM advance its digital presence.

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Appendix A

Research Overview and Participant Information: (Pyles, Educators)

This project is a qualitative research project on your experience as it relates to K-12, business, and MiSTEM partnerships. This research is not quantitative, meaning that, as a researcher, I am not trying to prove a hypothesis or make a judgment about a particular situation. I am simply trying to learn about your experience and tie that to my research. Your participation in this research is voluntary, and you are not required to participate. Should you choose to participate, you will have full control over what you choose to share and respond to during the interview. There will be two people involved in this research interview:

1. The Researcher: Ruthie Pyles
2. The Participant: You

Ruthie Pyles is affiliated with Vanderbilt University in the Leadership and Learning in Organizations doctoral program. All the data gathered for this project are connected to the pursuit of this degree and will inform MiSTEM in its efforts to understand K-12 and business partnerships. As a participant, you will be asked to evaluate and engage in conversation about your experience. Once again, you have full control over what you share, and your participation is voluntary. The interview will be scheduled for one hour. As a participant, you will be asked the following:

- You will be asked a total of nine questions by the researcher (me) with a follow-up question if needed.
- You will be given four questions on “activities related to the partnership.”
    - You may be asked by the researcher (me) to elaborate on your responses.
- You will be given two questions on “communication-related to the partnership.”

    - You may be asked by the researcher (me) to elaborate on your responses.
- Finally, you will be given three questions on "your perspective of the partnership."
    - You may be asked by the researcher (me) to elaborate on your responses.
- After these questions, I will ask if there is anything else you wish to include, and you will have a chance to respond or conclude the interview.

Information gathered during this study will be shared with my research partner, Chris Chopp, our Vanderbilt capstone faculty member, members of the Vanderbilt University capstone panel, the Vanderbilt community, and MiSTEM. All the data gathered will be placed in a cloud folder that is password-protected and accessible only by me and my partner, Chris Chopp. Should you have concerns about confidentiality related to this study, please contact me at jimary.r.pyles@vanderbilt.edu.

To ensure that, as a researcher, I accurately reflect my participants' experiences and remove any bias I may have, the interview will be recorded via Zoom. It will be transcribed and included in our final report; however, all documents will be destroyed at the conclusion of the project, no later than May 15, 2024. Once my research partner, Chris Chopp, and I have had time to analyze the information, we may reach out to you, the participant, to ensure that your experience has been captured accurately in this study.

Appendix B

Research Overview and Participant Information: (Chopp; Business & Business Partners)

This project is a qualitative research project on your experience as it relates to K-12, business, and MiSTEM partnerships. This research is not quantitative, meaning that, as a researcher, I am not trying to prove a hypothesis or make a judgment about a particular situation. I am simply trying to learn about your experience and tie that to my research. Your participation in this research is voluntary, and you are not required to participate. Should you choose to participate, you will have full control over what you choose to share and respond to during the interview. There will be two people involved in this research interview:

1. The Researcher: Chris Chopp
2. The Participant: You

Chris Chopp is affiliated with Vanderbilt University in the Leadership and Learning in Organizations doctoral program, and all data gathered for this project are connected to the pursuit of this degree; the data will also inform MiSTEM in its efforts to understand K-12 and business partnerships better. You will be asked to evaluate and engage in conversation about your experience. Once again, you have full control over what you share, and your participation is voluntary. The interview will be scheduled for one hour. As a participant, you will be asked the following:

- You will be asked a total of nine questions by the researcher (me) with a follow-up question if needed.
- You will be given four questions on “activities related to the partnership”.
    - You may be asked by the researcher (me) to elaborate on your responses.
- You will be given two questions on "communication-related to the partnership".

    - You may be asked by the researcher (me) to elaborate on your responses.
  - Finally, you will be given three questions on "your perspective of the partnership".
    - You may be asked by the researcher (me) to elaborate on your responses.
  - After these questions, I will ask if there is anything else you wish to include, and you will have a chance to respond or conclude the interview.

Information gathered during this study will be shared with my research partner, Ruthie Pyles, our Vanderbilt capstone faculty member, members of the Vanderbilt University capstone panel, the Vanderbilt community, and MiSTEM. All the data gathered will be placed in a cloud folder that is password-protected and accessible only by me and my partner, Ruthie Pyles. Should you have concerns about confidentiality related to this study, please reach out to me at christopher.c.chopp@vanderbilt.edu.

To ensure that, as a researcher, I accurately reflect the experiences of my participants and remove any bias I may have, the interview will be recorded via Zoom and an audio recorder. The interview will be transcribed and included in our final report; however, all documents will be destroyed at the conclusion of this term, no later than May 15, 2024. Once my research partner, Ruthie Pyles, and I have had time to analyze the information, we may reach out to you, the participant, to ensure that your experience has been captured accurately in this study.

Appendix C

Research Overview and Focus Group Participant Information:

This project is a qualitative research project on your experience as it relates to K-12, business, and MiSTEM partnerships. This research is not quantitative, meaning that as researchers, we are not trying to prove a hypothesis or make a judgment about a particular situation. We are simply trying to learn about your experience and tie that to our research. Your participation in this research is voluntary, and you are not required to participate. Should you choose to participate, you will have full control over what you choose to share and respond to during the focus group. There will be five people involved in this focus group:

1. Researcher: Ruthie Pyles
2. Researcher: Chris Chopp
3. Participant: Diane Owen-Rogers
4. Participant: Greg Johnson
5. Participant: Emily Geiger

Ruthie Pyles and Chris Chopp are affiliated with Vanderbilt University in the Leadership and Learning in Organizations doctoral program. All the data gathered for this project are connected to the pursuit of this degree and will also inform MiSTEM in its efforts to understand K-12 and business partnerships better. You will be asked to evaluate and engage in conversation about your experience related to K-12 and business partnerships. Once again, you have full control over what you share, and your participation is voluntary. The focus group will be scheduled for one hour. As a participant, you will experience the following:

- Participants will be asked a total of eight questions by the researchers (Chris Chopp and Ruthie Pyles), with follow-up questions if needed.

- Participants will be given three questions on "activities related to partnerships."
    - Participants may be asked by the researchers to elaborate on their responses.
- Participants will be given two questions on "communication related to partnerships."
- Participants may be asked by the researchers to elaborate on their responses.
- Finally, participants will be given three questions on "your perspective partnerships."
- Participants may be asked by the researchers to elaborate on their responses.
- After these questions, we will ask if there is anything else you wish to include, and you will have a chance to respond or conclude the interview.

Please note the following:

- There are no right or wrong answers.
- You do not have to agree with everyone in the focus group. We anticipate that people will have different perspectives.
- We want you to feel comfortable providing positive as well as constructive feedback.
- We will provide space for everyone to contribute, but we wish to remind you that participants are not required to respond to every question.

Information gathered during this study will be shared with our Vanderbilt capstone faculty members, members of the Vanderbilt University capstone panel, the Vanderbilt community, and MiSTEM. All data gathered will be placed in a cloud folder that is password-protected and accessible by Chris Chopp and Ruthie Pyles. Should you have concerns about confidentiality related to this study, please reach out to us at jimary.r.pyles@vanderbilt.edu or christopher.c.chopp@vanderbilt.edu. To ensure that, as researchers, we accurately reflect the experiences of the participants and remove any bias we may have, the interview will be recorded via Zoom. The interview will be transcribed and included in our final report; however, all documents will be destroyed at the conclusion of the project, no later than May 15, 2024. Once the researchers have had time to analyze the information, we may reach out to you, the participants, to ensure that your experience has been captured accurately in this study.

Thank you.

Appendix D

Interview Protocol

Business and K-12 Educator Interview Questions and MiSTEM Focus Group Questions

Project Question	Business Partner Interview Questions	K-12 Educator Interview Questions	MiSTEM Focus Group Regional Directors	Theory
What activities are MiSTEM and K-12 educators engaging in to recruit and retain their business partners?	1. Help me understand the process you went through while being recruited to participate in the K-12 education and business partnership.	1. Describe the process you experienced to secure a business partner for your project.		Co-value; relationship marketing
What messages and communication tools are MiSTEM and K-12 educators currently using to convey the mutual benefit of partnerships between business and STEM educators?	2. Share the types of messaging you were provided about the mutual benefits of a K-12 educator and business partnership (examples: themes, data, outcomes, stories) and who provided the information (K-12 educators, MiSTEM, or both) ▪ Share messages that would have been helpful in understanding the mutual benefits of partnerships that you did not receive.	2. Share the types of messages MiSTEM provided about the mutual benefits of a K-12 educator and business partnership (examples: themes, data, outcomes, stories). ▪ Share messages that would have been helpful in understanding the mutual benefits of partnerships that you did not receive.	1. Share the types of messages MiSTEM provides about the mutual benefits of a K-12 educator and business partnership (examples: themes, data, outcomes, stories). ▪ Describe messaging you believe would be helpful but do not currently provide. ▪ Who would provide that messaging?	Co-value; social exchange; relationship marketing
What activities are MiSTEM and K-12 educators engaging in to recruit and retain their business partners?	3. Describe the activities performed by K-12 educators or MiSTEM that convinced you to become a partner. ▪ Help me understand if there were any additional actions MiSTEM or K-12 educators could or should have taken to streamline the decision process for	3. How did the activities performed by you or MiSTEM assist in securing your business partner? ▪ Help me understand if there were any additional actions you or MiSTEM could or should have taken to secure your business partner.	2. Describe how MiSTEM's current activities assist in securing business partners? ▪ Help me understand if there are any additional actions you or K-12 partners should take to secure business partners.	Co-value; relationship marketing

	you.			
What messages and communication tools are MiSTEM and K-12 educators currently using to convey the mutual benefit of partnerships between business and STEM educators?	4. Help me understand the types of communication tools that were used in the recruitment process that helped convey the mutual benefits of partnerships (email template, brochure, database, sales sheets) and who provided them (K-12 educators, MiSTEM, or both). To what extent were the communication tools effective in conveying the mutual benefit of partnerships? a. Very effective. b. Somewhat effective c. Not effective Please elaborate on your responses.	4. Help me understand the types of communication tools used in the recruitment process that helped convey the mutual benefit of partnerships (email template, brochure, database, sales sheets) and who provided them (K-12 educators, MiSTEM, or both). To what extent were the communication tools effective in conveying the mutual benefit of partnership? a. Very effective b. Somewhat effective c. Not effective Please elaborate on your responses.	3. Help me understand the types of communication tools used in the recruitment process that helped secure the partnership (email template, brochure, database, sales sheets) and who provided them (K-12 educators, MiSTEM, or both). To what extent are the communication tools effective in conveying the mutual benefit of partnership? a. Very effective b. Somewhat effective c. Not effective Please elaborate on your responses.	Co-value; relationship marketing
What factors contribute to the costs and benefits of the partnership between K-12 educators, businesses, and MISTEM?	5. Describe some of the benefits you and your company experienced/are currently experiencing as a result of the K-12 partnership. ▪ Share any benefits you may not currently be experiencing that you would like to experience.	5. Describe some of the benefits you and your community experienced/are currently experiencing as a result of the business partnership. ▪ Share any benefits you may not currently be experiencing that you would like to experience.	4. Describe the benefits associated with K-12 educators and business partnerships.	Social exchange
What factors contribute to the costs and benefits of the partnership between K-12 educators, businesses, and MISTEM?	6. Help me understand some of the costs associated with the K-12 educators and business partnership. ▪ Are there actions that could be taken to minimize the costs?	6. Help me understand some of the costs associated with the K-12 educators and business partnership. ▪ Are there actions that could be taken to minimize the costs?	5. Help me understand some of the costs associated with K-12 educators and business partnerships. ▪ Are there actions that could be taken to minimize the costs?	Social exchange

What factors contribute to the costs and benefits of the partnership between K-12 educators, businesses, and MISTEM?	7. Describe the costs associated with the MiSTEM partnership. ▪ Are there actions that could be taken to minimize these costs?	7. Describe the costs associated with the MISTEM partnership. ▪ Are there actions that could be taken to minimize these costs?	6. Describe the costs associated with the MISTEM partnership. ▪ Are there actions that could be taken to minimize these costs?	Social exchange
What activities are MISTEM and K-12 educators engaging in to recruit and retain their business partners?	8. Share what actions are being taken to recruit and retain your business for current or future projects and who is taking those actions.	8. Share what actions are being taken to recruit and retain business partners for current or future projects and who is taking those actions.	7. Share what actions MiSTEM is taking to recruit and retain business partners for current or future projects. ▪ How are K-12 partners involved in that process?	Co-value; social exchange; relationship marketing
What activities are MISTEM and K-12 educators engaging in to recruit and retain their business partners?	9. Share your thoughts on what you think MiSTEM should be doing to recruit and retain business partners. ▪ Describe how those activities would be helpful.	9. Share your thoughts on what you think MiSTEM should be doing to recruit and retain business partners. ▪ Describe how those activities would be helpful.	8. Share your thoughts on what you think MiSTEM should be doing to recruit and retain business partners. ▪ Describe how those activities would be helpful	Co-value; social exchange; relationship marketing

Appendix E

Deductive Codes

Deductive Codes	Definition
Partnerships	Process by which actors cooperate, share responsibility and accountability, develop trust, and work toward a common objective.
Benefits	They refer to positive outcomes or rewards that individuals receive from participating in social interactions or relationships.
Network	They are exchange systems where actors are tied through business relationships that share an interdependency. Networks are tied together through actors, resources, and activities that engage in resource and social exchange to achieve relational and economic benefits. They can contain strong and weak ties and could be routine, modular, or customized.
Costs/Challenges	These refer to the financial impact, negative aspects, or sacrifices that individuals experience due to participating in social interactions or relationships. Difficult situations or obstacles (personal, professional, emotional)
Relationship Marketing	It is focused on building long-term relationships through communication and customer engagement and refers to the benefits and value that a stakeholder promises to deliver.
Value Co-Creation	This occurs when multiple actors engage in practices that affect competition, strategy formation, and innovation.
Communication	It is the act of sending, receiving, exchanging, or transferring information, such as direct marketing, traditional (face to face, phone calls, mailing), digital (email, websites, video conferencing platforms), and social media (LinkedIn, Facebook, Instagram).
Value Co-Creation	It occurs when multiple actors engage in practices that affect competition, strategy formation, and innovation.
Social Exchange	Relationships are created and maintained through a cost-benefit analysis.

Appendix F

Inductive Codes

Inductive Codes	Definition
Relationships	A state of being connected to things, people, or groups; networks, ecosystems, associations, etc.
Recruitment	Specific strategy and/or ask for engagement
Promise	What one will gain or receive from engagement
Documentation	Brochures, flyers, materials
Outcomes	Results, success, or consequence
Workforce	Individuals working or looking for work
Learning	Exposure or experiencing something and being impacted Work-based learning such as apprenticeship, internships, preparing for trade or professional jobs
Collaboration	Working with someone to produce or create something
Expectations	Duties, responsibilities, and obligations placed upon individuals Imposed externally by others rather than self-imposed

Appendix G

Analytic Memos; Pyles

Pyles: Analytic Memo #1

RE: Reflections on Literature Review

I was surprised to observe how sparse the literature on K-12 and business partnerships is. Nevertheless, the literature that I found has been extremely helpful in setting the stage for the challenges, costs, and benefits of K-12 and business partnerships. However, I had anticipated more research on this subject. However, some of the research on human resources and their perspectives on how K-12 and business partnerships should be structured and envisioned has been interesting. I am eager to discover how our study unfolds before incorporating too much of that research, as it may take us in a different direction. Nevertheless, I am excited about the connectivity and want to know how much connection there will be to this project.

Finding the correct theoretical and conceptual frames has also been challenging. I have been reading extensively on network, resource-based, and social exchange theories. Each of these theories has various aspects that apply to this work, but I prefer social exchange because it aligns with the literature on K-12 and business partnerships and centers our work on the relational aspect of the partnership. It also provides a solid foundation that speaks to the basic foundational needs of partnerships. Network theory is intriguing because partnerships are all about connections; networks are essential not only to how partnerships are created but also to how they are maintained. Network theory strongly influences how people find jobs and employment, which could align well with our work. Finally, resource theory is fascinating because it relates to each partner's contribution and how that exchange can provide both short- and long-term benefits for each partner.

After some nudging from our capstone advisor, I started examining ecosystem theory, collaborative empowerment theory, cross-boundaries, innovation-based entrepreneurship, stakeholder theory, and co-value creation. While all theories provided exciting angles from which to approach this work, co-value was the one that stood out from this new set of theories because it incorporated both value in exchange, which is essentially the value proposition, and value in use, which is the co-value creation and ultimate benefits of the partnerships. We decided to combine social exchange, as all partnerships are truly relational in nature, and co-value creation because the focus of this project is to help with the value proposition so that all the stakeholders—businesses, students, our partner organization, and the community—can benefit from co-value creation.

Pyles: Analytic Memo #2

RE: Reflection on Data Collection Process

When reading the literature, there appeared to be a clear distinction between business and educator roles. In much of the literature, the educator was a teacher, and the business partner worked in the firm and had the skills necessary to contribute positively to the partnership. However, as I began data collection with the educators, I realized that their role was more ambiguous. While some of the individuals I interviewed had traditional teacher roles, some were principals, referred to superintendents as proactive members in the partnership, worked as educational consultants, or even worked for an educational facility outside of a K-12 school. As the data collection process progressed, I realized that although the educator role was less structured than I initially anticipated, the educators shared similar perspectives on benefits and challenges. Some were acutely involved in the development of the partnership and had extremely targeted responses, while others were more removed; their responses were more generalized, providing opinions rather than specific examples.

Another exciting aspect of the data collection with the educators was their diverse perspectives on the type of partnership they believe is valuable. In some cases, a “plug and play” curriculum was preferred, allowing educators to quickly enter the STEM experience. In this case, the school was happy to pay for the materials and tools to ensure engaged learning. There was also a sentiment that teachers would “get on board.” Contrastingly, I interviewed educators who were not interested in “plug and play” and wanted to create an experience that fit their teaching style. Each of the educators gave specific reasons regarding why they preferred one approach over another, and it was fascinating to see the relationship, value proposition, and co-creation of value from different perspectives.

Finally, I noticed that MiSTEM’s role with educators is less established than I initially anticipated. Its value proposition appears to be unclear for some, and for others, it seems clear but narrow. The educators often referred to lengthy training sessions, access to professional development, and support through MiSTEM funding. However, responses to questions that focused on MiSTEM and its role were high-level and abstract.

Pyles: Analytic Memo #3

RE: Data Analysis

In the data collection process, my focus was on K-12 educators, and my partner focused on the business interviews. In the data analysis process during unstructured readings, I was intrigued by some of the elements evident in the business interviews.

First, I was intrigued by how many business partners talked about connection; it took on many forms in the data. For some, it meant this was a passion project; for others, it was a connection to other businesses that created spaces to enhance the STEM ecosystem. For yet others, it was connecting students to enhance future opportunities. Learning how connections took on multiple forms in the data was interesting.

It was also interesting to hear how businesses were eager to better understand the value proposition of the materials provided. I was also intrigued by their desire for a structured process that would allow for more targeted information on outcomes and results. I appreciated that when discussing concerns, they highlighted personal and work obligations and an overall concern for time away from work. I acknowledge that time away from work or family was present in the literature and was observed in both the K-12 and business interviews. Business partners also talked about the “K-12 hurdle,” which I loosely interpreted as red tape that interfered with objectives. Overall, the business partners' experiences were strong, but more robust communication of value would be beneficial.

Finally, I found the conversation about apprenticeships and internships interesting. As someone who has worked in higher education where internships are top of mind, I am always eager to understand how we can apply best practices, such as experiential learning, earlier in an educational experience.

Appendix H

Analytic Memos; Chopp

Chopp: Analytic Memo #1

RE: Reflections on Introduction and Literature Review

In our capstone project, we are examining the role of business partnerships with K-12 education to address the STEM talent pipeline. The MiSTEM Network is our partner organization. As a government agency established in the Department of Labor and Economic Opportunity (LEO) and working with the Michigan Department of Education (MDE), MiSTEM uses a combination of policy and strategy to catalyze more partnerships to benefit STEM education across the state.

At this point in our research, we have narrowed our focus and project questions down to the following:

1. What messages and communication tools is MiSTEM currently using to convey the mutual benefit of partnerships between business partners and STEM educators?
2. What factors contribute to the costs and benefits of the partnership between K-12 educators and businesses?
3. What activities is MISTEM engaging in to recruit and retain its business partners?

Our conceptual framework employs two theoretical frameworks: social exchange theory and value co-creation theory. We intend our theory to be a lens through which we examine business and K-12 education partnerships.

Value co-creation will help us examine how value in use emerges through partner exchanges and results in mutual benefit. Value co-creation highlights the importance of collaboration and interaction in creating value, as well as the contextual nature of partnerships; it emphasizes the dynamic nature of these interactions that evolve over time.

Social exchange theory will help us apply cost-benefit analysis to examine the economic and social outcomes of partnerships. Key to social exchange theory are trust, reciprocity, and norms. By examining the long-term benefits of trust in relational partnerships, we will provide insights into the critical components of partnerships that will impact the STEM talent pipeline in meaningful ways.

We are in the midst of creating three qualitative interview tools: an interview tool for educators; an interview tool for business partners; and a qualitative, semi-structured interview protocol for a focus group of MiSTEM network regional directors. We are proposing questions for the interviews that aim to use the theoretical frameworks as well as the project questions to understand the role of integrating business and education partnerships in addressing the skill and talent pipeline shortcomings that are already prevalent in Michigan.

Chopp: Analytic Memo #2

RE: Reflection on Data Collection

These past 10 days, I have contacted over 20 different people from K-12 education, businesses, and the MiSTEM Network to schedule interviews and focus groups. Our data collection is framed as a series of interviews with K-12 educators and businesses, ideally six educators across three regions of Michigan, and six business partners. We are also conducting a focus group of MiSTEM regional directors in Region 1: West Michigan, Region 3: Metro Detroit area, and Region 1:6 the western Upper Peninsula.

The titles of educator and business partner have proved much more fluid and elusive than anticipated as we tried to trace people partnering with the MiSTEM Network on grant-funded projects. Many of the partners have been in adjacent educational spaces, and there are not as many cross-sector partnerships. The amount of turnover has also been a hurdle when trying to schedule our interviews and focus groups.

Chopp: Analytic Memo #3

RE: Reflection on Findings

After the coding the data, I began thinking about the themes and patterns that were emerging from the data analysis. I arranged my findings, supported by illustrative quotes, as I worked through this process in preparation for a meeting with my research partner to discuss our findings. Here are some of the emergent themes I was thinking about in preparation for our meeting to deliberate about findings.

From a high level, we were working to understand the dynamics of partnerships between educators and businesses that were supported and facilitated by the MiSTEM Network. We focused on communication strategies, costs and benefits, and recruitment and retention efforts.

Some of my initial thoughts about the communication tools used to convey the mutual benefit of partnerships were that, in more cases than not, partners assumed the mutual benefits of the partnership rather than explicitly communicating and agreeing upon it. This assumption led to a misalignment in expectations and missions between educators and business partners. These communication tools ranged from face-to-face meetings to phone calls and emails. The face-to-face meetings seemed to foster relationship-building, and partnerships that had more clearly defined roles tended to be more successful, especially in getting established and sustainable over time.

When reflecting on costs and benefits, successful partnerships demonstrated engagement and motivation by both partners. Time emerged as the most significant cost associated with partnership development. Educators expressed challenges in finding the time to integrate real-world partnerships into their curriculum on top of their day-to-day demands of work.

With regard to recruitment and retention, leveraging networks and relationships emerged as crucial strategies for successful partnerships. More of our data focused on recruitment than on retention. Moreover, most of the partnerships we examined focused on informal recruitment and did not emerge through a recruitment or retention strategy from the MiSTEM Network. A potential recommendation is to develop strategy for improving recruitment and retention of partners.

As I think about the findings, it is clear that effective communication, clear role delineation, and a recognition of maximizing time commitments are emergent themes. It is also clear that strategic networking plays a pivotal role in fostering successful partnerships between MiSTEM Network, K-12 educators, and businesses. In our Recommendations section, we will examine how the MiSTEM Network can refine its communication strategies, optimize resource allocation, and enhance collaboration frameworks that will maximize the mutual benefits from partnership efforts.

Appendix I

Document Analysis Table

Document Media Selected	Data Content Presented	Concept Illuminated	Evidence
Business & Education Partnership Guide	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses & Educators Purpose: ▪ Messaging on benefits of business and education partnerships ▪ Segmentation by service levels	Concept: ▪ Messaging on mutual benefits of partnership between businesses and educators Codes: ▪ Partnerships ▪ Benefit ▪ Network ▪ Outcomes ▪ Promise	▪ Benefits for business ▪ Benefits for schools and students ▪ Dual benefits ▪ STEM supporter, STEM professional, STEM resource
Place-Based Community Partnership Website	Produced by: ▪ MiSTEM Intended Audience: ▪ Educators ▪ Administrators ▪ Businesses Purpose: ▪ Messaging on benefits of community partnerships	Concept: ▪ Place-based community partnerships Codes: ▪ Communication ▪ Motivation of partners ▪ Outcomes ▪ Benefit ▪ Network	▪ Community impact ▪ Better education ▪ Better environment ▪ Enrich student learning ▪ Partnership roles ▪ Steps for creating partnership
MiSTEM regional websites: Region 1 Region 2 Region 3 Region 4 Region 5 Region 6 Region 7 Region 8 Region 9 Region 10 Region 11 Region 12 Region 13 Region 14 Region 15 Region 16	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses ▪ Educators ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	▪ For business ▪ For educators ▪ Business and community ▪ Teachers ▪ Education

Region 3 For Teachers	Produced by: ▪ MiSTEM Intended Audience: ▪ Educators ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits ▪ Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	For Teachers landing page: ▪ Graphic on business and education integration ▪ Two 50 second videos on the benefits of working with Region 3 ▪ Links to 13 teacher programs ▪ A link to the MiSTEM grants page ▪ Request for information form
Region 8 Educators	Produced by: ▪ MiSTEM Intended Audience: ▪ Educators ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Educators drop-down menu: ▪ Career development resources ▪ Professional learning ▪ MiSTEM grants ▪ STEM resources ▪ West Michigan PBL
Region 11 Education	Produced by: ▪ MiSTEM Intended Audience: ▪ Educators ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Education landing page: ▪ A small paragraph about MiSTEM ▪ MiSTEM pillars ▪ Region 11 intermediate school districts (ISDs) ▪ MiSTEM regional map ▪ Newsletter sign up form Education drop-down menu: ▪ Educational mini-grants ▪ Professional development ▪ Resources for educators

Region 13 Educators	Produced by: ▪ MiSTEM Intended Audience: ▪ Educators ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Educators landing page: ▪ Educator opportunities ▪ Educator resources ▪ MiSTEM Network projects
Region 14 Educators	Produced by: ▪ MiSTEM Intended Audience: ▪ Educators ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Educators drop-down menu: ▪ Career and technical education ▪ Computer science ▪ Externships ▪ Grants ▪ Mathematics ▪ Professional learning ▪ Science pages
Region 16 Educator	Produced by: ▪ MiSTEM Intended Audience: ▪ Educators ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Educator Resources landing page: ▪ Descriptions and hyperlinks to 30 resources and activity kits for educator use

Region 3 For Business	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	For Business landing page: ▪ MiSTEM business education partnership brochure ▪ 7-minute MiSTEM career pipeline video ▪ Request for information form
Region 10 Business Resources	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Business Resources landing page: ▪ Great Lakes newsletter ▪ Hyperlinks to past issues of an employee talent pipeline newsletter ▪ Five stats on why you should care about building a STEM-based talent pipeline ▪ Four benefits for business ▪ A 25-minute video on internship opportunities ▪ Link to a STEM pipeline blog with stories
Region 11 Business and Community	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Business and Community landing page: ▪ Header: Business and Education Partnerships ▪ Content from the MiSTEM Business and Education Partnership brochure is used to outline types of partnerships—STEM resource, STEM supporter, and STEM professional—with examples of activities in each type of partnership.

Region 13 Business and Community	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Business and Community landing page: ▪ Interactive chart that groups partnership activities by an organization's resources and time. ▪ The chart has three levels: high (investment), medium (investment), and entry-level (investment) ▪ Each activity has a short description with 1 of three action items: Contact Us, Donate Today, or Learn More. ▪ The Contact Us and Donate Today buttons link to a form to fill out. The Learn More button takes the user to additional sites that provide more information on the associated topic.
Region 8 Business Partners	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses ▪ General population Purpose: ▪ Messaging for MiSTEM audience on mutual benefits	Concept: ▪ Communication tools and messaging on mutual benefits Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Network ▪ Collaboration ▪ Outcomes ▪ Benefits ▪ Workforce ▪ Learning	Business Partners landing page: ▪ Three examples of business and education partnerships happening in the community ▪ Content from the MiSTEM Business and Education Partnership brochure is used to outline types of partnerships; STEM resource, STEM supporter, and STEM professional with examples of activities in each type of partnership.
3P Learning: Connecting Students to the World	Produced by: ▪ MiSTEM Intended Audience: ▪ Businesses ▪ Educators Purpose:	Concept: ▪ Communication tools and messaging on mutual benefits Code: Communication ▪ Documentation ▪ Benefit ▪ Workforce	▪ Real-World learning ▪ experiences ▪ Benefits for business ▪ 3P learning ▪ Workforce talent development

	▪ Messaging on project, problem, placed based education and benefits for business	▪ Value co-creation ▪ Learning	
Transforming STEM Experiences Together	Produced by: MiSTEM Intended Audience: Businesses and educators Purpose: Messaging on MiSTEM mission, vision, partnership, benefits, outcomes	Concept: ▪ Connect with MiSTEM to build STEM future Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Benefit	▪ Connect with MiSTEM ▪ MiSTEM pillars, mission, and vision ▪ Encourage 21st century skills ▪ Solve issues at local level ▪ Contribute to vitality of community ▪ Foster career awareness, exploration, and preparedness
Transforming STEM Experiences Together Brochure	Produced by: MiSTEM Intended Audience: Businesses and educators Purpose: Messaging on MiSTEM mission, vision, partnership, benefits, outcomes	Concept: ▪ Connect with MiSTEM to build STEM future Code: ▪ Communication ▪ Partnership ▪ Cost/challenge ▪ Documentation ▪ Benefit	▪ Connect with MiSTEM ▪ MiSTEM pillars, mission, and vision ▪ Encourage 21st century skills ▪ Solve issues at local level ▪ Contribute to vitality of community ▪ Foster career awareness, exploration, and preparedness