The Manufacturing And Engineering Partnership Program: An Examination Of A Partnership Between Manufacturing And CTE

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THE MANUFACTURING AND ENGINEERING PARTNERSHIP PROGRAM:
AN EXAMINATION OF A PARTNERSHIP BETWEEN MANUFACTURING AND CTE

Laura Schoenborn-Preuss, Ph.D.

Western Michigan University, 2022

Manufacturing is struggling to find people to fill open positions in the various career opportunities they represent. The skills gap or skills needed by manufacturers has caused challenges in filling those open positions. Adding to this dilemma is that student interest in these careers has reduced, with the focus being on obtaining college degrees right out of high school. Due to these changes, manufacturing and education are partnering in ways to increase student interest and fill open positions.

This study is looking to better understand one such partnership and how the activities students’ experience influence their career decision making. The Manufacturing and Engineering Partnership Program (MEPP), located in the Midwest partnered with local manufacturing companies to increase awareness and student interest in manufacturing. This research will add to the literature on whether partnerships like the MEPP program can add to the pipeline of people needed in the manufacturing industry.

The purpose of this case study is to understand how the MEPP partnership’s activities shaped participating students’ interest in manufacturing careers. In specific, the goal is to capture students’ responses to the experiences in this partnership program and how they influenced their
future career plans. These outcomes can help partnerships evaluate their activities or assist parties looking to create a partnership understand from a student perspective what activities most made an impact.

Upon examining the results on the sixteen interviews, the partnership program does influence student interest in manufacturing careers. In the case of the sixteen students, ten of the 16 students are in or still pursuing careers in a manufacturing field. All sixteen students noted benefits in the career exploration process. Recommendations for future research is to have more studies to determine if students get into a manufacturing careers later in their lifetime.

The implications are that the manufacturing industry and K-12 partnerships represent new opportunities to help in the career exploration and career decision making process. Providing more opportunities for students to understand and apply for the program like MEPP could be beneficial. As discussed in prior themes, the exposure MEPP provided further helped students to determine if a manufacturing related career is the right opportunity for them. This presents an opportunity for partnerships like this to investigate providing classes like MEPP as an elective course for exploring career opportunities.

The research set out to understand how the activities in a K-12 and manufacturing partnership program influence career decision making. From the perspective of the students, there were multiple activities that were impactful and not all connected them to careers in manufacturing. While 10 of the 16 students currently chose careers in manufacturing, all 16 of the students found the Manufacturing and Engineering Partnership Program to be a beneficial part of their career decision making process. The exposure this partnership presented students helped them to determine a course of action for their future careers.
THE MANUFACTURING AND ENGINEERING PARTNERSHIP PROGRAM: AN EXAMINATION OF A PARTNERSHIP BETWEEN MANUFACTURING AND CTE

by

Laura Schoenborn-Preuss

A dissertation submitted to the Graduate College in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Educational Leadership, Research and Technology Western Michigan University April 2022

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Louann Bierlein Palmer, Ed.D.
Richard Zinser, Ph.D.
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DEDICATION

To my grandpa, Lyle Lothschutz, you will always be one of the smartest people I know. Due to need and obligation you were unable fulfill your interest in formal education but that did not stop you from learning. My education is a representation of what you instilled in the next generation of family and now I hope to instill that value of lifelong learning into the next generation.
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To my family and friends, especially my husband Cory. The incessant questions on when I would be done made it impossible to quit even when I wanted to. I appreciated all the love and support; I truly would not have completed this dissertation without you as a part of this journey. Most of all, to the children who have impacted my life, Nina, Makenna, Brayden, Ryan, Mason and Ady. May you set your goals high, believe in completing what others say you cannot do, and find your guts to overcome the fears that can be instilled upon you from outside sources. Let this dissertation show you that you too can complete your goals if you set your mind to it.

Lastly, to my DeWys Manufacturing family. I found my passion because of you. This dissertation would not be possible without the people I work with and strive to change the perception of. Being a part of an organization that does more than talk about problems but sets out to redefine the status quo is what led me to completing my dissertation. I became a better person by being a part of this organization and being able to play a role in building partnerships. Because of you, I will continue to use my voice to change those perceptions, reshape the way society thinks about manufacturing and continue to focus on the education needed for the future.

Laura Schoenborn-Preuss
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CHAPTER 1
INTRODUCTION

There has been a decline in high school students interested in careers in manufacturing, with 75% of students never having a counselor or teacher suggesting a trade or vocational school as a means to a viable career (Leading2Lean, 2020). Less than three out of 10 Americans noted they would encourage their children to pursue a manufacturing career, and only five out of 10 Americans believe manufacturing jobs are interesting and rewarding (Giffi et al., 2017). This decline is due to a variety of reasons, ranging from perceptions of parents about career technology education (CTE) jobs, to the social push for all students to obtain four-year degrees (St-Esprit, 2019). Indeed, the perception of CTE is often that it is a track for students who are incapable of going to college (Dougherty, 2016). Due to the negative perception of manufacturing, many parents lack knowledge of the industry and perceive these occupations as physically demanding with low wages and few long-term benefits (IW Staff, 2018).

These challenges have required manufacturing to look for a new way to connect with high school students, such as forming partnerships. In increasing numbers, employers are “adopting” high schools, working with teachers and administrators, and helping to build career exploration opportunities (Spiker, 2019). While some research has occurred on these types of partnership programs, not enough is known about why some students who participate in these partnership program continue on into manufacturing careers, while others do not.

Background

The U.S. manufacturing industry offered many employment opportunities in the 1950s, with 43% of all U.S. jobs at that time in manufacturing (Ohanian, 2014). In the 1980’s, manufacturing lost 1.4 million due to less demand for steel, apparel, and textiles (Houseman,
Today manufacturing only employs 8.5% of the workforce primarily due to an increased use of technology and robotics (Amadeo, 2019).

At the same time that manufacturing jobs were decreasing due to technology and economic issues, there was also a push occurring for college-focused jobs. In the 1980s, a perceived inability for the U.S. to compete in international markets led to a paradigm shift in how to approach education (Pitre, 2004). For two decades, K-12 schools raised academic and graduation standards, and promoted a “college for all” mantra that made it known that college was the primary pathway to success (Symonds et al., 2011). Many students were discouraged from CTE by teachers and parents who instilled the idea that the “American Dream” job requires them to attend a college or university (IW Staff, 2018). Students taking academic credits towards college increased, but this has changed the landscape of CTE courses for students. While 85-90% of HS students do earn some CTE credits (Sublett, 2019), CTE “completers,” or those who take a series of CTE courses, has decreased, with the largest decrease being in the manufacturing category (Silverberg et al., 2004). Many students currently engaged in CTE courses are now focused on postsecondary paths such as accounting, health care, and computer sciences (Malkus, 2019).

Despite fewer manufacturing positions then in past decade, the current manufacturing workforce has shortages due in part to the attrition of older workers. The U.S. Bureau of Labor Statistics estimates that there are 12.8 million people working in manufacturing and of that, 2.8 million are 55 and older (Harris, 2020). For manufacturers this means that nearly 25% of the U.S. manufacturing labor force are at least 55 years old and getting close to retiring (Gold, 2018). These workers are difficult to replace as there is not an adequate pipeline coming in to replace them. In addition, it is estimated that manufacturing will need to employ an additional
1.96 million workers by 2028 to produce the goods needed for the United States’ growing economy (Giffi et al., 2015). Overall, the manufacturing industry and the United States will continue to face difficulties in productivity without the proper skilled workforce to replace retirements and newly created positions in manufacturing.

The development of work-ready individuals to fill open manufacturing positions has led to the creation of partnerships that allow for collaboration on formal education, soft and technical skill training, as well as work-based opportunities (Jackson et al., 2016). High school partnerships seek to also create work-ready individuals but have an added interest due to many obstacles each side faces. For manufacturing, creating a partnership is a way to improve societal and parent perceptions, increase the pipeline of students to cover retirements, and reduce a perceived skills gap.

Many manufacturers already participate in or are familiar with the college and international partnership as a successful option for undergraduate students (Burns et al., 2018). High schools are also familiar with college and international partnerships through middle college programming, which is when a high school student is dual enrolled in a college program (Michigan Department of Education, 2018) or vocation education and apprenticeship programs in Germany. Education also has seen a number of changes in educational requirements and a push for college and career readiness. The U.S. Department of Education requires that all students be able to think critically, solve real-world problems and be successful in the 21st century and beyond (Mishkind, 2014). Educators are interested in partnership to provide relevance to classroom learning (Griggs et al., 2018).

Manufacturing careers are plentiful for students graduating from a K-12, CTE program. However, many students do not know what occupations exist due to a lack of career exploration.
The Association for Career and Technical Education (ACTE) (2008) states, “without structured guidance activities, young people tend to drift through their high school education without gaining knowledge of all the career opportunities available to them or the skills that are required” (p. 2).

This study explored activities within one specific partnership, the Manufacturing and Engineering Partnership Program (MEPP), located in one high school in a Midwestern state, along with 12 partner manufacturing companies. High school instructors, advisors, and industry partners set out to create an opportunity where students could be exposed to manufacturing related experiences and careers. This partnership created a vision where board collaboration, alignment on outcomes, shared decision making, and financial and human resources are used to create an internal school program with external learning opportunities.

Without career exploration, students are challenged to make good decisions about college and careers (Kalchik & Oertle, 2010). The goal of this partnership is to increase student interest in manufacturing-related careers. Specifically, it should increase manufacturing interest, increase manufacturing careers, or increase manufacturing education for the students graduating from this program. The MEPP was created based on the belief that creating an environment where students could learn about manufacturing-related occupations will help to increase student interest in manufacturing-related careers and education.

Indeed, career decision making is one of the most complicated and important decisions individuals face (Levin et al., 2020). Determining what career to choose in high school can be a large challenge for students to face. High schoolers question which profession to go into and strive towards obtaining occupational identity (Kirdok & Harman, 2018). Partnerships creating career exploration activities help to build that bridge for students. However, what extent these
explorations effectively drive students’ attitude, behavior, and career or work outcomes is unknown (Jiang et al., 2019).

**Research Problem Statement**

Manufacturing is an essential part of the economy and produces a wide variety of parts and products for the United States and around the world (Obama, 2012). Manufacturers need additional skilled labor to operate in their companies. There have been advances in technologies and opportunities that have created double-digit job growth in manufacturing since 2017 (Giffi et al., 2018). However, these companies lose an increasing number of employees each year due to retirements, and the negative perceptions of manufacturing and a mismatch in skills is otherwise known as a skill gap (Weaver & Osterman, 2017).

CTE has an important role in creating an educational path for manufacturing students. CTE can offer career exploration, work-based learning opportunities and skills needed for the workplace. It can make for an easy transition from school to work and supply employers with trained workers (Eichhorst, 2015). However, manufacturing CTE credits taken by students have reduced in number over the decades (Dalton et al., 2013). This is in part due to perceptions of manufacturing as well as increase in programming geared towards computer science and health care (Malkus, 2019). Typically, high school students are shying away from trade education, with only 17% of surveyed 18- to 24-year olds encouraged by family and counselors to pursue a career in manufacturing (Moutray & Swift, 2013). A trade school, otherwise known as technical or vocational school, is where manual or specialty skills are taught such as plumber, machinist, or mechanic (Career School Now, n.d.).

In Michigan, the Michigan Merit Curriculum requirements also changed high school students’ focus on being ready for post-secondary education and on the state being committed to
the best educated workforce (Michigan Department of Education, 2006). The Michigan Merit Curriculum has standard graduation requirements and guidelines for demonstrating proficiency for all high school students in the state of Michigan (Michigan Department of Education, 2006). Therefore, many students are focused on getting into college and on a more narrowed pathway to success. The “college-for-all” mantra has challenged the students’ ability to connect a program of study with opportunities in the labor market (Symonds et al., 2011). Such focus can neglect a full range of choices that could equip students with in-demand skills and has resulted in an absence of students entering in-demand skilled trades like manufacturing (Giffi et al., 2015).

As one means to address these issues, industry have long partnered with educational institutions to help create a pipeline. Initially starting with community colleges, such college and industry partnerships date back to the 1970’s and have allowed for access to industry standards and sharing of ideas and other resources (VentureWell, 2019). These collaborations have provided opportunities to bridge the gap between classroom and real-world experiences (Burns et al., 2018). Through attributes of trust, respect, support and ownership, many sustainable partnerships have been established (Pillay et al., 2014). The partnerships have established numerous opportunities for students such as the Michigan Advanced Technician Training (MAT2), which is a government, community college, and industry partnership offered in various locations in Michigan that offers young adults a career pathway and employers a pipeline of talent (Baumann et al., 2014).

Manufacturers and educators are pursuing such partnerships to actively address the needs of students and employers (Flynn et al., 2015). These partnerships are increasingly important due to the competitive environment, global competition, and rapid technology changes (Marinho et al., 2020). Partnerships provide mutual benefits towards resolving the differences between
education and industry and share practices that are timely and responsive to each other (Flynn et al., 2016).

Indeed, manufacturers are more actively involved in the K-12 educational system to improve the school-to-work connection by creating partnerships. In Kansas, the University of Kansas School of Medicine along with the Kansas City Kansas Public Schools created after school and summer programs to graduate students with additional credentials and workforce experience to have them prepared for college or careers in health care (Luaces et al, 2019). In the Appalachian Mountains, a group of businesses along with other supporters joined up with education to create the K-12 STEM education and STEM workforce development programs (Gonzalez et al., 2014). The new STEM education was created to bring more awareness in K-12 of STEM education and career opportunities along with create an adequate supply of qualified individuals for middle-skilled occupations (Gonzalez et al., 2014). In the case of Detroit Public Schools, they have a Partnership and Innovation Division where outside companies, and entities can apply to partner with them (Detroit Public Schools, 2020). These partnerships create college and career readiness activities for K-12 students, monetary donations, or targeted resources to enhance the academic achievement of their students (Detroit Public Schools, 2020). The problem is we do not know whether partnerships in K-12 and the manufacturing industry have the same effect that college and industry partnerships have had. Success of a partnership is in whether or not students find interest in manufacturing-related careers and obtain skills that benefit student and industry, as well the program building a pipeline of people to fill the open positions.

There is a lack of understanding on whether the partnerships between manufacturing and education are creating the pipeline of students needed to fill open positions. Manufacturing is concerned about a lack of students prepared for the careers they offer, and partnerships are being
created to improve student interest in manufacturing-related careers. From the previous research we understand that manufacturing opportunities are vast and that there is a lack of individuals interested and available to fill those open positions. We also know that partnerships are an important way to connect industry and education to provide programming that will be relevant education towards filling those positions. However, there is a lack of understanding regarding the student perspective on the activities in these partnerships. It is important to acquire new knowledge around this topic so a more informed decision can be made on if activities within a partnership can benefit individual businesses, students, and education sector.

This study sought to understand K-12 and manufacturing partnerships by capturing information on what partnership activities influence student interest in manufacturing. The results of studying a K-12 partnership with local manufacturers provides insight into what extent the activities a partnership provides helped to get students into manufacturing careers or related post-secondary education. The research could have significant influence on how to replicate a K-12 and manufacturing partnership in other schools and attract additional students into the manufacturing world.

**Purpose Statement and Research Questions**

The purpose of this case study was to understand how the MEPP partnership’s activities shaped participating students’ interest in manufacturing careers. In specific, the goal was to capture students’ responses to the experiences in this partnership program and how they influenced their future career plans. These outcomes can help partnerships evaluate their activities or assist parties looking to create a partnership understand from a student perspective what activities most made an impact.
This study seeks to answer the following research questions:

1. What can we learn from the experiences of students who enrolled in one K-12 and manufacturing partnership program?

2. For students engaged in a K-12 and manufacturing program, how was their career planning influenced by various activities within that partnership program?

3. Which specific partnership activities appeared to have the most influence on such students and why?

The desired outcomes of the study were to understand what types of partnership activities are most influential to student participants. This in turn could help recruit more students to participate in partnership programs and have more graduating students either enter manufacturing or furthering their education in manufacturing.

**Conceptual Framework and Narrative**

This study captured the perceptions of high school students who participated in the MEPP program, to understand how this program may have influenced the students’ interest in a manufacturing related career. The study sought to better understand what activities within this partnership program influence students towards a career in manufacturing or a decision to pursue other career opportunities.

Within the MEPP program, there are three full-time teachers involved, one of which teaches a semester long MEPP class. The other two sit on the board as advisors who teach in CTE-related courses at the high school. There is one school counselor who helps to connect students to this program, follow up with students during the program, as well as lead quarterly MEPP partnership meetings.
The 12 manufacturing companies represent various industries from plastic or food manufacturing to sheet metal manufacturing. All companies provide different career opportunities and provide experiences that allow students to see many more manufacturing-related occupations. The goal of this partnership is to provide exposure and exploration in manufacturing careers to students in their senior year of high school. The outcome from this class is the goal of creating a pipeline of students pursuing a manufacturing career right out of high schools with a partner company or pursuing an education that would lead them into a manufacturing career.

The partnership created a class that is a semester long and taught by one instructor who facilitates various topics such as lean manufacturing principles, work ethic, initiative, and teamwork (Klein, 2021). During this Fall semester class, the partner companies come into the classroom to provide presentations about their companies and what occupations they provide; students tour multiple partner companies of their choice as well as participate in resume building and practice interviews. During the second semester of their senior year, students determine whether they want to apply for the full MEPP program. Applying for the full MEPP program means they have opportunity to interview with partner companies for summer and full-time positions with the MEPP partner companies after graduation. This signifies students are interested in manufacturing careers within a partner company and would like to interview with them. Thus, some students are engaged in only the Fall semester MEPP class, while others will continue with the full MEPP program, that may include a summer position, as well as a future position with a partner company.

The school has a counselor who not only encourages students to participated in the MEPP class, but also sets the agenda and leads partnership meetings. The counselor collects data at the
end of the school year on student outcomes and presents the information at MEPP board meetings. The counselor also collects feedback from partner companies and discusses opportunities for improvement for each program year. The counselor tracks which companies hired the MEPP students, but they are unable to track the students who only complete the MEPP class to determine their occupational choices after graduation.

Figure 1 offers a visual concept map that depicts the major elements of the study. The MEPP program activities were reviewed through the perspective of the students who participated, as well as from teachers engaged in the program. Those perspectives led to an understanding of what activities, influenced students’ career decision making. The research also revealed other influencers that drove students’ career decisions not connected to the partnership program.

Figure 1

*Conceptual Framework*
Overview of Methods

A qualitative, instrumental case study methodology was used to understand how activities in an industry and high school partnership program influence student career interests. Qualitative research is used to answer questions about a participant experience, meaning, and perspective (Hammarberg et al., 2016). By using a case study approach, a researcher can investigate a contemporary phenomenon in its real-life context (Yin, 1996). An instrumental approach uses a singular case to gain a broader understanding of a particular issue (Stakes, 1995). The research used a purposive sampling of students from the last five graduating classes with a goal of interviewing eight students who continued within the MEPP program following high school graduation, and eight who only completed the class while in high school. Purposive sampling is used when selection of the participants is deliberate to help in yielding the most relevant data (Yin, 2016). A purposive sampling can also be used to understand what happened and why and most often used in case study evaluations to be sure the sampling will reveal reasons something did or did not happen (Balbach, 1999).

The research had two subgroups, one being students who applied for the full MEPP program and the other being students who did not apply for the full MEPP program. Having eight students from each subgroup yielded 16 students total to interview. Semi-structured interviews were utilized, which allowed me to have several key questions but also allowed for further explore based on an interviewee’s response (Gill et al., 2008). The questions asked touched on themes such as what the experiences were like in the partnership program as well as what impact the partnership had on career decisions making. Specifically, the research sought to understand how the experience influenced a student’s decision to pursue a career in manufacturing.
Informal or conversational interviews with members of the partnership program were also conducted. Interviews were conducted with the instructor for the class, the counselor assigned to the program as well as three of the business partners. Conversational interviews generate verbal data through talking about specific topics with research participants (Stebbins, 2008). It is a valuable method for gaining insight into someone’s perception, understandings, and experiences in a phenomenon (Coughlan et al., 2009). Conversational interviews are used for the purpose of generating data using open-ended, in-depth, or unstructured interview formats (Stebbins, 2008). These interviews added to understanding to the broader context of what they see from the MEPP activities. The interviews also add depth and additional quotes to the overall conversation about the partnership program and the activities involved in the program.

**Significance of Study**

The manufacturing industry does not have the pipeline of potential workers opting into the skilled trades industry. In the United States, 80% of manufacturers report a shortage of qualified candidates (Selingo, 2017). The skills gap, which is when someone lacks the skills the employer demands, contributes to this shortage, which can be seen through employer demands and hiring experience (Weaver & Osterman, 2017). There are also 2 million new positions expected by 2028 on top of the 2.69 million vacancies from retiring workers, this represents a huge challenge faced by the manufacturing sector (Manufacturing Institute, 2018).

The perception of manufacturing has also plagued the industry. Less than 50% of Americans believe manufacturing careers are interesting, rewarding, clean, and safe (Giffi et al., 2017). Adding to that, the college-for-all environment had been established by high school counselors and teacher which led students towards professional careers requiring bachelor’s
degrees (Deitrickson, 2018). This has left manufacturing in a “talent war” competing with technology giants, medical fields, and many other careers (Giffi, 2017).

In response to the skills shortages, manufacturers are turning towards partnerships to encourage school-to-work transition programs to address the labor demands (Pillay et al., 2014). Partnerships are not a new conversation in higher education or international communities. There are currently several different partnership arrangements being used in education around the world (Kumari, 2016). These partnerships include apprenticeship models, college and industry partnerships and government collaborations. Partnerships like these have created learning environments that can influence student career decision making (Flynn & Pillay, 2013). They help to fulfill needs for students, educators, and industry.

The significance of this study was to understand partnership activities in one high school and manufacturing collaboration. While literature suggests that partnerships in the college and international sector help to achieve established goals, such as workplace learning opportunities, building curriculum, and recognition of qualifications (Polesel et al., 2017), little is understood about collaboration at the high school level. Does the high school level collaboration achieve the same partnership goals as college and international level partnerships? By understanding the student perspective of partnerships activities at a high school level, further replication and adjustments of such programs can be achieved at other high schools.

**Chapter 1 Closure**

Manufacturing is struggling to find people to fill open positions in the various career opportunities they represent. The skills gap or skills needed by manufacturers has caused challenges in filling those open positions. Adding to this dilemma is that student interest in these careers has reduced, with the focus being on obtaining college degrees right out of high school.
Due to these changes, manufacturing and education are partnering in ways to increase student interest and fill open positions. This study looked to better understand one such partnership and how the activities students’ experience influence their career decision making. This research adds to the literature on whether partnerships like the MEPP program can add to the pipeline of people needed in the manufacturing industry.
CHAPTER 2
LITERATURE REVIEW

Since its inception, manufacturing has long been a part of the American landscape and seen as the engine of growth for the economy (Felipe et al., 2019). For decades, careers in manufacturing offered secured positions that many would retire from. In recent years however, changes in the landscape have made these careers less desirable and giving way to new and more desirable forms of employment and independent work environments (Hyman, 2018). Public perception once deemed manufacturing as a viable future career option has changed, so today very few students focused on it in the K-12 arena. As a result, the K-12 school curriculum and graduation requirements have likewise evolved, making changes in the vocational education system, and emphasizing curriculum that focuses on college readiness as a centerpiece of educational initiatives (Gaertner & McClarty, 2015). Since the purpose of this study is to understand high school partnerships, this chapter will provide an overview of the history of vocational education, the decline and perception of manufacturing, and examples of partnerships that influenced the study.

**Historical Perspectives on Career and Technical Education**

For many generations, vocational education was an important function of the United States economy. In the early 20th Century, President Theodore Roosevelt urged society to create vocational education that would provide industrial training in the urban areas and agricultural training in the rural areas (Gordon, 2014). The industrial training would help the United States be more competitive with the international markets (Gordon, 2014). During WWII, there was a large increase in need for people to pursue vocational education training (Gordon, 2014). The objective was to have immediately employable people to fill the positions that were vacated by
workers enlisting in the war efforts (Gordon, 2014). This vocational education would allow students to learn a trade and, upon graduation, fill positions in industries that would both help the United States be competitive in the world and add to the American economy.

In 1914, the Commission on National Aid to Vocational Education was formed out of the urgent need to get more young adults into vocational education. The purpose of the commission was to promote precollegiate vocational education in agriculture, industrial trades, and home economics (Steffes, 2014). This commission suggested that vocational education would help in four ways. First it would meet the individual needs of students and allow the schools to provide a more meaningful curriculum to the students. Second, it would provide the ability to help students be prepared for life and work, helping students to understand the needs of life outside of school and within the workplace. Third, it would allow students to learn by doing through schools teaching more hands-on practical skills like that of theory and practice. Fourth, it would introduce more regarding the idea of utility into the educational systems and to the students, making a big change in traditional reading, writing, and arithmetic (Freidel, 2011).

The vocational education system was once a way for immigrant adults to acclimate to the needs of the American workforce and provide opportunities to the working-class citizens (Greenberg, 2007). In time, it became the opportunity to transition from the K-12 educational system to the workforce, or perhaps onto a secondary vocational education system, for all students. Students could study within the traditional education setting and still learn how to work with various tools, work in agriculture, or with other manufacturing systems. Popularity with students led to tremendous growth for vocational education, increasing from only 31,000 in 1920 to 548,000 in 1940. By 1970, enrollment had increased to 853,000 students (Friedel, 2011).
In 1963 The Vocational Education Act was established. This act sought to help people of all ages, in all locations and with various skills and abilities (U.S. Department of Education, 1965). It was meant to address social inequity by having programs for people from a variety of backgrounds that were having problems succeeding in a traditional vocational system (Doughtry & Lombardi, 2016). The act helped to add new programs in a variety of areas such as business and health. The act addressed eight key areas for proper funding. It first addressed where the funding would go, focusing on vocational education in the high school and to college students. Second, the act was directed towards high school students that have either completed high school or had left school. Third, it would be used to address issues with people needing retraining in the labor market. Fourth, it would be geared towards people with life obstacles or in an economic status that held them back from achievements in school. Fifth, it would be focused on people with disabilities. Sixth, it would help to build schools that would address the vocational education systems necessary for the market. The seventh focus was to employ guidance counselors to help get people into the programs and address any issues they may have. Lastly, the eighth area it addressed was training for educators in the various fields being established (Friedel, 2011). This is the first time America focused on building occupational-focused and specialized CTE schools to help build the future for student and employment (Doughtry & Lombardi, 2016).

The Vocational Education Act would later be amended in 1968 and in 1972 when it was called Education Amendments of 1976, Title II-Vocational Education. These amendments expanded Congress’ leverage on who vocational education served (Wonacott, 2003). With each amendment, the act would further serve students with disabilities, bilingual students, disadvantaged students, and students that were focused on occupations that were not traditional
for their gender (Wonacott, 2003). The amendment also stipulated where funds would be used with a focus on economic and social demands (Threeton, 2007).

In 1984 The Carl D. Perkins Vocational Educational Act was established to help further define what vocational education meant and for whom. It outlined improvements for the vocational education programming as well as increasing access for students with special needs (Wonacott, 2003). The intent of this amendment was to provide access to all students while addressing the needs of the economy (Threeton, 2007). This act was amended in 1990 and was called The Carl D. Perkins Vocational and Applied Technology Education Amendments of 1990, which mandated the use of federal funding to improve student performance (Wonacott, 2003). This would be the first-time federal funding would be directed to all populations of people, especially for technology programs (Wonacott, 2003) and opened vocational education opportunities to people with special needs (Friedel, 2011). In 1998, The Carl D. Perkins Vocational and Applied Technology Education Amendment was improved with a focus on increased funding and strengthening performance and accountability (Dortch, 2012). The funding for special populations was removed and gave direction to states to provide the services that would help those populations succeed (Wonacott, 2003). The federal government also outlined data that the states would need to report on, such as proficiencies in academics, attainment of a secondary degree, data on what students did after, including postsecondary education, advanced training, military service, or employment, and whether a student participated in a program that led to nontraditional employment (Wonacott, 2003).

In 2006, the act was changed to the Carl D. Perkins Career and Technical Education Act. The shift to calling vocational education, career and technical education as well as increasing academic rigor and aligning high schools with post-secondary education programs (Friedel,
The act established new requirements and helped to link high school and vocational education along with focusing on greater accountability for integrating academics standards (Threeton, 2007). While the focus of the amendment was still on learning vocational subjects, it would further address disadvantaged and dislocated people (Friedel, 2011). The amendment helped to create new programs in the secondary schools to address the needs of employers, to get people employed, and to incorporate employers in the learning process, as well as to help establish the curriculum, and to give students hands-on learning opportunities (Friedel, 2011).

In 1994, President Clinton signed the School to Work Opportunities Act. The act had three components: school-based learning; work-based learning; and connections between school and work. Each component had specific requirements. School-based learning began with bringing career awareness and counseling for career exploration, guiding students to declare a major before 11th grade. The Act required programs that not only met state and academic standards but also enabled students to obtain a skills certificate. Approved programs needed to integrate academic and vocational learning, evaluate their effectiveness and students’ progress, and deliver secondary education transitions or job training. The goal of work-based learning was to create training and education that provided experience within a company atmosphere. Work experience, industry standards, and workplace mentors were a few of the requirements for this component of the Act. The third and final component of the Act connected the first two components by requiring both schools and employers through business advisory committees. These committees evaluate the program’s overall effectiveness. Members from each group needed to work well together for effective coordination (Wraga, 1998).

In 2018, President Trump signed into law the reauthorization of the Carl Perkins Act. By doing this, he authorized more funding for Career and Technical Education (CTE) programs as
well as gave more authority to local states to create the standards necessary to educate students in their CTE programs. This reduced federal control and allowed states to individually set standards and goals for the students attending the programs they offer in any given state.

**History of the MEPP Program**

The Manufacturing and Engineering Partnership Program started in the fall of 2011 out of a conversation revolving around the topic of helping students to see other options than going directly to college. Local industry and the educators at a midwestern high school wanted to show manufacturing opportunities that could lead to fulfilling careers and would pay for additional education as needed. An educator at the high school made industry contacts over his years of teaching and presented an opportunity to unite the conversation and create a program that could benefit all parties. A core group of employers along with educators at the high school worked together to create what would now be known as the MEPP program and the MEPP class that is taught yearly. The school board agreed to the addition of this class and added the program to their curriculum offering, solidifying the presence of this partnership in the school. This group then became the board of directors for the program, determining rules and program requirements that would define the program and help determine future business partners.

To become a business partner, an employer must apply, answer specified questions and be willing to be an active participant in the MEPP class and program. There are several requirements for business partners participating in the MEPP program, such as being actively engaged in the MEPP class, participating in presentations, and opening the business to the students for tours and career opportunities. MEPP partners must have an inclusive tuition reimbursement program that covers all or part of college, apprenticeship, or professional
development programs. They must commit to interviewing students from the program in a timely manner and attend the twice a year meeting about the program.

The MEPP class is a .5 credit course that was originally only open to 12th grade students during the first semester of their senior year; however, the opportunity has been extended to 11th grade students as well. The class is 18 weeks long and could enroll up to 40 students. The class is broken up into various manufacturing topics such as lean manufacturing principles, set-up reductions, and value stream mapping. The class engages the students in understanding the manufacturing environment and presents activities that allow the students to problem solve how to make improvements in the work environment. These activities include competitions, written summaries, and video presentations. Students also choose three partner companies to tour to better understand the businesses as well as how what they are learning applied to each company. Business partners also make presentations in the classroom about the company, what careers they have to offer, and cultures they have in their organization. Students ask questions and create summaries on each presentation that help them compile information on each business partner.

The MEPP program also spends time on interpersonal skills, teamwork activities, and resume building. The career counselor at the high school participates in coaching students on how to build a resume, practice interviewing skills, and writing a thank you note. Students spend a good portion of the class working in teams to better understand how to work with people and communicate effectively. The business partners found that these activities needed to be a part of the program upon creation, as so many students neither understood manufacturing nor how to present themselves to secure the positions they want for their futures. The business partners then interview students during the semester to give them added practice and preparation for when the student applies for the full MEPP program.
In the second half of the semester, more emphasis is made on the students on applying for the full MEPP program. The MEPP class offers students an understanding of manufacturing and the careers it offers while aligning them with activities that will help them in their decision-making process. The next step is for a student to determine if they want to apply for the full MEPP program, which would allow them to interview with a business partner for a summer, part-time, or full-time opportunity. While positions are not guaranteed, students are guaranteed an interview with the top three partner companies they choose to apply for. This application process must be completed by the January following the MEPP class, as during that next 18 weeks, the interviews and job offers will be made.

An important note is that the MEPP class is not a requirement for applying for the MEPP program and interview process. Most students that apply have been in the MEPP class; however, some students choose to go to a career and technical education center, which inhibits them from participating in this course. These students are told about the MEPP program, some apply and are given employment opportunities by the MEPP partner companies.

Once a student applies for the MEPP program, the business partners they select are given a full outline of the courses the student took and grades they received, a summary on performance in the MEPP class by the teacher, a resume, and cover letter. This information is then used by the business partner in the interview process. It is a requirement of a business partner to contact the students that submit resumes and to provide an interview to each candidate. Business partners are not required to offer positions to each candidate. There are some business partners that do not receive any applicants, while other partners might have multiple candidates. Once interviews are conducted and decisions are made, business partners are expected to let the school know if any students were hired at their companies.
History of Education in Michigan

Michigan was the first in the union to have a government-led educational system, which started in 1835 and was called Article X (Brouillette, 1999). Article X would lay groundwork on funding, leadership as well as length of the school year and shifted education from being family and religion to a collective view of society or secular view (Brouillette, 1999). For many decades, the focus would be on how to finance a centralized education system and general educational studies. It wasn’t until the late 1800’s that more specific policies were enacted that directed schools. The first being the National Education Association’s Committee of Ten which defined the educational system and curriculum to be taught as well as noted the difference between “college-bound and terminal students” (Sass, 2020). In 1916, John Dewey introduced a philosophy on education that incorporated hands-on learning into the current function of formal education (Williams, 2017,). Dewey was credited with helping to establish the Progressive Education Association which was associated with a student’s freedom to develop naturally and using their interested as a motivator for learning (Palm, 1940). Wars, segregation, gender, and civil rights played a large part in the changes in education during the following decades (Sass, 2020). In 1965, President Johnson passed the Elementary and Secondary Education Act (ESEA) primarily to fund the education of disadvantaged students (Levesque, 1995). This act was amended in 1994 after Nation at Risk was published in 1983 stating schools needed to strengthen graduation requirements, that schools adopt more measures and rigorous standards, and teachers needed better preparation (Jorgensen & Hoffman, 2003). ESEA turned into Improving America’s Schools Act of 1994 and led to the Goals 2000: Educate America Act which both were focused on focused on the needs of all students by looking at content, assessments, and accountability (Jorgensen & Hoffman, 2003). In 2002, President Bush signed into law the No Child Left Behind
Act (NCLB), which focused on funding and added clarity to the importance of achievement testing throughout a student’s K-12 programming (Jorgensen & Hoffman, 2003).

The Michigan educational system has adopted numerous changes to the K-12 system since the turn of the current century. In 2006, the focus shifted to college readiness as a requirement to be competitive in the global economy (Michigan Department of Education, 2006). The governor at the time, Jennifer Granholm, enacted the Michigan Merit Curriculum, which set forth a series of increased academic requirements that a student would need to fulfill to graduate. This emphasis on the mastery of a set of rigorous requirements was meant to demonstrate that “Michigan is committed to having the best-educated workforce” (Michigan Department of Education, 2006). However, an unintended consequence of students needing to focus their attention on high school credits to fulfill the new Michigan Merit standards was more students making college readiness a priority and fewer students pursuing vocational education programs.

In 2010, Michigan adopted Common Core requirements, which aligns with over 45 other states. The goal was to set a common educational standard that all states would adhere to. The curriculum framework primarily focused on math and English requirements, with an overarching goal of College and Career Readiness. However, due to the restricted requirements of the Common Core model, there was a substantial divide between the new standards and CTE (Meeder & Suddreth, 2012). Common Core divided “college readiness” and “career readiness” and did not connect how English and math were embedded in careers and ultimately CTE curriculum (Meeder & Suddreth, 2012).

In 2014, then Governor Rick Snyder proposed making changes to the Michigan Merit Curriculum that would allow CTE courses to count for academic credit provided they had more
rigor and academic content (Smith, 2017). College and Career Readiness is a key focus for the new curriculum and took a more holistic approach in saying that the students should be ready for further education and employment in the workplace after graduation (Michigan Department of Education, 2017). There are four main requirements of being college and career ready: understanding how to use technology and tools for learning and communicating; understanding how to use argument and reasoning with or against others; learning effective ways to communicate and collaborate, as well as learn to problem solve (Michigan Department of Education, 2017). Along with these new learning processes, educators are required to work with students on obtaining career exploration opportunities and opens the door to new alternative learning method (Michigan Department of Education, 2017). Due to these new opportunities, more students are participating in CTE related courses.

Decline of Manufacturing

While manufacturing was once the bedrock of the U.S. economy, the public perception of working in a manufacturing company has changed from the Industrial Revolution to current day. The changes in public perception along with changes in our educational systems, and parent focus on pursuing college degrees after high school has led to manufacturers struggling to fill open positions (Giffi et al., 2015). Compounding the issues is the steady wave of retirements as older workers age out of their careers, according to a Deloitte study, 10,000 are retiring a day in the United States (Gold, 2018) and never-ending international pressures to keep up with advances in capabilities. This section will dive into understanding these challenges that have caused the decline in the workforce development pipeline.
**Education System**

The industrial trades were a popular area of study in 1982, with 15% of high school students graduating from an industrial trade program. However, by 1994, only 8% had graduated from an industrial trade program (U.S. Department of Education, 2000). This decrease was brought on by a shift in the education system in an attempt to address the competition for non-industrial jobs in the US and abroad during the 1980’s (Gordon, 2014). Non-industrial jobs included positions like accounting, medicine, and information technology. Many high schools promoted a college preparatory curriculum, requiring more classes, and emphasizing new standards and testing for students and teachers (Gordon, 2014). This shift was reinforced by policies that only students labeled as low-skilled or underperformers would be referred to CTE programs (Lane, 2001). Therefore, many students lost the ability to take vocational education courses to explore additional and potentially interesting career options (Jacob et al., 2017).

Enrollment in post-secondary or college vocation education programs inversely followed patterns of increased labor market demand (Silverberg et al., 2004). As a preference on college preparation and the stigma on industrial trades grew in high school programming, this further perpetuated the challenges colleges faced in vocational education in the industrial trades sector. The result was fewer graduates from advanced vocational education programs at the community college level and in the skilled labor trades and more students enrolled in high-tech fields of study like information technology (Lane, 2001).

**Retirement**

Another issue creating labor demands on manufacturing is the number of employees retiring from the workforce. Projections show that between 2018 and 2028, there will be 2.69 million positions open from retirements (Giffi et al., 2018). Currently, 35% of the manufacturing
workforce is over the age of 54 (Singer, 2019). As these skilled workers retire, the manufacturing industry is having a harder time replacing these valuable employees (Giroux, 2014). Due to the retirements and the reduction in students pursuing a skilled trades education, there are not enough trained people learning welding, fabrication, and machining to replace the retiring workforce (Seed, 2011). By 2028, the expected amount of jobs manufacturing companies will need to fill, due to new openings and retirements is estimated at 4.6 million from (Giffi et al., 2018). These staggering numbers add to the overall concern about the future of the U.S. manufacturing industry.

**International Factors**

The United States is not only one country that is involved in vocational education. Japan, China, and Europe, especially Germany, have strong vocational education programs that help them compete with the United States economy. Each of these nations has developed a vocational education system to help them remain economically viable (Min & Zhu, 2019). The countries each have a partnership with educator and industries to determine how to maintain the practice and development of vocational training and education. These partnerships found five main factors to develop vocational education. The first is to carry out open learning and effectively improve vocational education’s function, which serves the regional economy and society. The second factor is to meet the dual needs of the industry and education with employment and recruitment markets. The third factor is to intensify education through teaching reform and innovation, and to study personnel training. The fourth factor is to establish the concept of lifelong education and build a modern vocational education system for everyone. The fifth factor is to design a system for the structure of vocational education (Wu, 2010). If a country has a
developed general education, but not a well-developed vocation education system, it will be impossible to make fast economy developments (Wu, 2010).

Germany has a different way of handling vocational education. Students are only required to attend school full-time through the 10th grade. Their secondary school system provides options that incorporate a traditional liberal arts education with more functional vocational education and is divided into three tracks. In Germany, 86% of the student population attended school that is either general education, a form of dual education which is a combination of general and vocational education, or straight vocational education (Tsiplakides, 2017). In 2017, 1.3 million students in Germany were enrolled in a vocational education training program (Spees, 2018).

Valuable to Germany’s approach is that they have a vocational education system that is fully funded by the federal and state governments, employers play a vital role in development of curriculum and competency standards and students are dual enrolled meaning that work in the employer’s business as well as go to school (Spees, 2018). Germany also incorporated companies into the schooling process through involvement in apprenticeship programs. Students and companies adhere to a contract that provides guidelines for both to follow and to help with the learning and training process (Graf, 2016). Germany has 1,461 dual study programs that student can choose from (Graf, 2016). Companies are involved with the creation of the training programs otherwise known as qualification models and are a vital part of the conversation on what people need to be successful in working for their companies. These qualification models are a big part of the success for school, students, and companies and incorporate work-based training and education (Wolter & Kerst, 2015). Germany continues to find ways to increase the
employer presence and to make sure that the training provided meets the needs of the student and employer.

**Skills Gap**

“Skills gap” is the difference between the skills employers need and the skills candidates possess. The first *Skills Gap* report in 2001 highlighted the challenges manufacturers face due to a lack of qualified candidates (Jasinowski, 2001). This gap persists today because potential manufacturing candidates continue to be underqualified for the positions manufacturing employers have open (Larsen et al., 2018). While the skills gap conversation crosses many career occupations, for the present study, the focus will be on manufacturing careers and occupations.

The scholarly literature examines the skills gap in terms of either technical skills or soft skills (Christo-Baker et al., 2017). According to Kivunja (2015), students graduating from high school and looking to obtain employment today are not graduating with skills that easily transfer to manufacturing employment. So, while 96% of academics believe students are prepared for the real-world employment upon graduation, 11% of employers felt that same way (Jackson et al., 2016; Jasinowski, 2001). The disconnect between academia and employers has been a persistent issue known as a mismatch of skills. This lack of communication and coordination between education and manufacturing has led to challenges in manufacturing being able to fill their employment needs (Weaver & Osterman, 2017). Currently, five out of ten manufacturing positions go unfilled due to the skills gap or mismatched skills (Giffi et al., 2018). Over 70% of manufacturers surveyed in the *Skills Report* (Giffi et al., 2018) said finding people was the number one concern about the company’s future.
High School Career Decision Making

It is understood that career decision making is an important issue facing young generations (Zainudin et al., 2020). Career decision making is a rational process involving emotions and the rational decision-making process is often insufficient unless individuals can emotionally manage the uncertainty, ambiguity, and unpredictability involved in the decision-making process (Farnia et al., 2018). High school students are influenced by various groups of people. According to the National Center for Education Statistics, the greatest two influences are family members and themselves; however, teachers, friends, counselors, and employers were influencers for some students (Oymak & Hudson, 2018). Seeking a career can be a challenging decision and feel overwhelming due to the numerous pathways one can follow (Farnia et al., 2018).

There are several theories related to career choice and how a student determines what path to follow. While this study does not try to connect one theory to the partnership program and how students make decisions, it is important to understand some of the key elements that might come through during the interviewing process. These follow theories are not all encompassing, rather they outline a few of the major theories known in the career decision making field of study.

John Hollands theory of vocational or career choice is widely used that proposes people select work that match their vocational interest (Woods & Hampson, 2010). In this theory, John Holland created a code, assessment, and ranking to characterize vocational personalities and work environments (Nauta, 2010). This code of vocational types and characteristics turned into an acronym RIASEC, which stand for Realistic, Investigative, Artistic, Social, Enterprising and Conventional (Wood & Hampson, 2010). By developing this coding system, Holland can
connect a person’s characteristic towards exploring occupations that are congruent with their personality (Nauta, 2010).

Albert Bandura’s social cognitive theory takes the approach that people are not just reactive to external events but are more proactive, self-reflecting, and self-regulating when it comes to career decision making (Bandura, 1999). Self-regulation refers to one’s ability to systematically organize their thoughts, feeling and actions to obtain their goals (Usher & Schunk, 2018). Bandura believes that people control their own motivation and that they must make sound judgements on their capabilities to ultimately regulate their own behaviors (Bandura, 1999). The belief is that people are internally motivated and, because of that, those motivations manifest into goal-directed actions (Schunk & DiBenedetto, 2020).

Based on Bandura’s social cognitive theory came the social cognitive career theory (SCCT), which tries to understand the process through which people form interest, make choices, or achieve success in an occupation (Lent et al., 2000). The SCCT model looks at two variables an individual’s self-efficacy and their outcome expectations, which are predictors of career success (Tokar et al., 2007). SCCT believes that career development is influenced by objective and perceived environmental factors like educational experience or available financial support (Lent et al., 2000).

Donald Super’s developmental self-concept theory looks at self-concepts and the stages of development from growth to exploration to establishment, then maintenance and lastly the decline stage (Ireh, 1999). Super looks at occupations from a life-span approach with the belief that a career is a sequence of positions held over a lifetime (Super & Hall, 1978). Super’s belief is that psychological as well as social-economic factors influence how someone views themselves and their situation (Ireh, 1999). Super felt that an individual’s self-concept could be
impacted by feedback, perception of others, and whether they met the standard criteria of being in the role they should be in during life (Walker-Donnelly et al., 2019).

John Krumboltz’s social learning theory of career selection discusses how students determine career paths for their future. The theory explains how education and occupational preferences are acquired and how selection of an occupation is made (Krumbolz et al., 1976). The theory looks at four influencers, genetic endowment, environmental conditions, learning experiences, and task accomplishments (Krumbolz et al., 1976). Krumbolz believed that influencers of career decision making came from positive role models, good observational learning as well as rewards and reinforcements (Bezanson et al., 2016). Thus, skills are accumulated through education and career choices and people leverage that experience to ascend through a profession therefore the theory assumes people are active learners (Johnson et al., 2017).

While there are many theories surrounding career decision making and how student’s make career choices, John Krumboltz’s social learning theory of career selection is the theory most aligned to the MEPP partnership study. We understand that career decision making is complex, and some adolescents may encounter difficulty making a career decision (Germeij & Verschueren, 2006). Many times, adolescence make decisions based on limited information (Julien, 2004). What is known is that adolescent’s turn to a variety of information sources like parents, peers, guidance counselors, and people working in industry (Julien, 2004). Therefore, it is important understand the career decision making topic as part of a partnership program geared towards getting students interested in manufacturing related careers.
Current Career and Technical Education Partnerships

In the last decade, manufacturing has experienced a tremendous bout of growth but, due to the lack of formal technical education and a change in student interest in the skilled trades area, there is a shortage of student’s interest in or trained in the skilled trades necessary to fill open manufacturing positions (Work to Do, 2014). This has led to manufacturers becoming more actively involved in K-12 career and technical education (CTE) partnership (Subramanian & Clark, 2016). These partnerships play a vital role in addressing the challenges and bringing new and real-life resources to the classroom (Subramanian & Clark, 2016). Success in changing the CTE climate will require both parties to work together in unprecedented ways. However, for manufacturing and education to have a successful collaboration, the barriers between them must be minimized (Murphy et al., 2011). Rather than only focusing on specific activities and programs merely donating resources or money, employers are becoming actively involved in improving K-12 education. For example, traditional one-on-one pairing of schools and businesses is being replaced by collaborations addressing educational improvement/reform (Imel, 2001). This alignment is critical for business and industry to have access to a trained labor force and critical for students’ ability to enter the workforce and find jobs (Hargis, 2011).

Societal Views

The general perception of society is that manufacturing is a dark, dingy, dead-end place to work with routine activities and little room for meaningful career advancement (Giffi et al., 2017). Pictures of Henry Ford’s assembly line where employees are doing repetitious work that is perceived a mindless is what many people think of when the idea of manufacturing careers are discussed (Barr, 2018). Deloitte and The Manufacturing Institute’s 2017 study found that only 5 in 10 Americans surveyed believed manufacturing can offer jobs that are rewarding, clean, and
safe (Giffi et al., 2017). The loss of 45% of Michigan manufacturing jobs between 2000 and 2010 only helps to enforce the perception that manufacturing jobs are not where students should focus their future (Luthra, 2020). Schools and counselors play an important role in painting the picture of a future career in manufacturing. When they cannot see one, they are unlikely to encourage students to pursue one.

Between 1990 and 2009, general academic credits earned by student went up, but CTE credits earned declined from 4.2 to 3.6 credits (National Center for Education Statistics, n.d.). With manufacturing CTE courses decreasing by 9.5% (National Center for Education Statistics, n.d.). CTE still evoked an image of outdated information that does not prepare students for college or career aspirations (Revelli, 2018). Students, parents, and education staff often perceive CTE programs negatively until an understanding of the goals and mission of CTE are established within the school environment (Shanklins, 2014). However, CTE is relevant and, by engaging students through work-based and hands-on learning, will provide a seamless pathway between high school, college, and the workplace (Revelli, 2018). Students will only enroll in CTE courses when they can see a career path (Gean, 2010). This is an important aspect for manufacturers: they must participate in showing the career paths to all parties to help open the minds and the doors for all to understand what CTE education is truly all about.

Parents also play a role in the societal views and the career choices student make. Parents are considered primary instruments in career-related decision making in their children’s career development (Garcia et al., 2015). Studies show that parents have a strong influence on occupational development and understanding of work (Hirishi et al., 2011). Even if a student finds an occupation’s activities appealing, a parent not accepting of what that occupation represents will cause a student to not feel confident in the choices they are making (Gordon &
Steele, 2015). Parents may have worked in an era where manufacturing related positions have seen many layoffs and declines. During the recession in the late 2000’s, there were layoffs in tool and die automotive that reduced the number employed to 67,100 (Business and Labor Statistics, 2011) and manufacturing lost 5 million jobs (Long, 2016). Many parents were a part of, or knew people, who were laid off, therefore they pushed students towards business or health care, so they get paid well, do not work physically hard, or have a stable career (Long, 2016). However, research shows that much is dependent on the “socio-economic status” of parent. For instance, middle-class parents typically envision their children in a professional occupation that requires a university education (Irwin & Elley, 2013). Intermediate and middle-class parents are more open to their children working in white collar positions, identified as practical or vocational careers (Irwin & Elley, 2013). According to Torpey (2015), between 2012 and 2022, there will be over 50 million jobs open for CTE graduates, and 3.4 million of these will come from manufacturing industry. The Association for Career and Technical Education note that 27% of people with less than an associate degree earn more than a person with a bachelor’s degree. They also note that technical or associate degree holders can out-earn bachelor’s degree recipients by $2 to $11,000 (Association for Career and Technical Education, 2008).

**Striving for Change**

To understand how educators and manufacturers should work together they first must understand the needs of the students they are investing time in. Students in one study said the most effective ways to communicate information about CTE courses are through presentations at their high schools, attending a career day at their high school or receiving information from a friend (Gean, 2010). This important information can shed light on how manufacturers can start to get involved. The graduation rate of students in CTE programming is 93% versus the national
freshman graduation rate of 80% (Association of Career and Technical Education, 2008). It is also understood that most completers in CTE programs find employment immediately after high school (Ahn, 2006). Therefore, manufacturing must work with educators to become part of the process of getting students in, and graduated from, CTE-related programs so those students could become potential employees within their workforce.

**Partnerships**

Partnerships are a way for business, government, education, or other entities to work together towards a mutual goal. According to Robertson et al.’s, *Public Private Partnership* book (2012), partnerships are a “cooperative institutional arrangement between public and private sector actors” (p. 1). Partnerships are a collaborative way to achieve specific goals of both parties (Oviawe, 2018). The belief is that through this common agenda, greater progress can be made towards alleviating many complex issues (Kania & Kramer, 2011). In a CTE partnership, students can access valuable on-the-job experience, workplace learning opportunities, and teachers can learn new ways of improving instruction of a program and industry ensures that their needs are met with input on curriculum (Polese et al., 2017). The power this partnership can have is that through a challenge an organized group of people seeking to make change through the same lens can cause immediate action and simultaneous response from all the parties involved (Kania & Kramer, 2013).

The effects of a partnership can be seen immediately across parties, but there are challenges that can come from these partnerships. Research tells us that there are five conditions for a successful partnership: a common agenda, shared measurement, mutually reinforced activities and continuous communication, and an organization driving the collaboration (Daun-Barnett & Lamm, 2012). These conditions turn into benefits for the school and the industry
partner. Benefits for the school include delivering relevant concepts to real-world situation and financial support (Griggs et al., 2018). For an industry partner, the benefits are increased productivity by obtaining new employees, more effective recruitment, and opportunity to give input on curriculum (Grigg et al., 2018). Another aspect of a successful partnership is the mutual belief that the partnerships are a necessary investment in the future and that the partnership will make a difference (Kubota, 1993).

Manufacturing and K-12 partnerships have many similar interests that are necessary for successful partnerships. Many believe that manufacturers should be invested in community outreach where they can help to build curriculums in a collaborative environment (Robinson, 2017). Due to change in automation and the wake of Industry 4.0, the manufacturing work environment, and skills necessary to perform tasks are changing. The belief is that in order to close the skills gap, manufacturers and educators need to engage in collaborative connections because none of these entities can close the gap on their own (Robinson, 2017). The logic is that these partnerships can provide complementary capability and competencies through a collaboration of manufacturing and education (Griggs et al., 2018). Manufacturing can provide education with resources that can help educators provide the programming needs to help make students successful in a global market (Griggs et al., 2018). These resources could be monetary or physical equipment that students can practice on. They could also bring real life situation into student education that can demonstrate procedures on how to create the service or product necessary to run the manufacturing business (Subramanian & Clark, 2016). Students could also visit manufacturing workplaces to see the skills they are learning about in action. They can be provided with job shadows, work-based learning experience and on-the-job training opportunities.
While many believe in the benefits of strong partnerships, others see few tangible benefits to a manufacturing and K-12 partnership. Beyond donations and volunteers, some believe these partnerships reduce the focus on what is important (Bennett & Thompson, 2011). They are concerned that having corporate money involved in education takes away from the educational process, and that organizations are doing it for self-serving purposes and not to help improve or better educate students. Further, any education that is happening due to an employer presence is only to create a skill to employ and not for the better good of a student’s education (Boyles, 2000).

**Current Partnership Examples**

In the United States, there are partnerships that already taking place in the K-12 and manufacturing industries. All these partnerships seek to engage employers to target the skill demands and identify training and employment strategies to meet the needs of these employers (Spiker, 2019). President Obama (2015) presented in his Upskill Initiative a need for partnerships. The President encouraged employers, educators, and other leaders to work together so employer did not do all the training on their own (Obama, 2015). The report outlines a need for multiple firms or single employer engagement with local colleges so that the critical needs can be identified and strategically resolved (Obama, 2015).

In Michigan, The Marshall Plan was signed into law to help support the creation of partnerships. In 2018, Governor Rick Snyder signed the document that supports the development of the current talent pool by offering to financially supporting, innovative partnerships between education and business (Marshall Plan, 2018). This plan requires educators to submit documentation that explains the purpose and process of the partnerships to receive financial support towards implementing or sustaining these partnerships. In December of 2018, the first
award winners were announced. Money went towards 260 entities, which included 90 businesses, 64 school districts, 33 postsecondary institutions, 16 industry associations, 10 Michigan Work! Agencies, and 47 nonprofit organizations (Walsh, 2018). One of the award winners was Detroit Public Schools, which is creating an employer-driven career readiness programs in manufacturing, professional trades, and health care (Walsh, 2018).

In Ottawa County, Michigan, the Ottawa Area Intermediate School District has a program known as The Careerline Tech Center, which has been partnering with local employers to provide work-based learning, job shadows, full and part-time employment, and other work experiences (Metz & Dietzer, 2018). The Careerline Tech Center has furthered their partnerships toward a middle college program which allows students to complete an associate degree with their 13th year of high school. This partnership is with a local community college and manufacturer and geared toward four manufacturing degrees that have been the most challenging for the manufacturer to find employees in (Metz & Dietzer, 2018). Within this program, students can earn money by working for the manufacturing company while getting free college credits provided through this partnership (Metz & Dietzer, 2018).

The Jackson Area Manufacturing Association started the Academy for Manufacturing Careers in 2005. This academy was formed in the Jackson area with a collaboration between over 70 manufacturers and the South-Central Michigan Works! to meet the needs of the employers in the area (Enterprise Group, 2019). This program helps to build a pipeline of talent by training adults, unemployed, or under-skilled individuals as well as offering programs for the youth in various tracks that allow youth opportunities to learn and experience manufacturing careers (Jackson Area Manufacturing Association, 2019). The Academy for Manufacturing was a front runner in the partnership and has apprenticeship, certificate, and customized training for
employers and potential employees. In 2014, the Academy for Manufacturing was spotlighted by the White House as a promising approach and, in 2014, they were recognized by the Great Lakes Manufacturing Council as one of 30 Talented Workforce Initiative programs within eight U.S. States (Jackson Area Manufacturing Association, 2019).

Another form of partnership in high schools is through advisory boards. All state approved CTE programs in an intermediate school district in Michigan are required to have an advisory board to help in ensuring their program is effective. An active and well-represented committee can be a powerful support to a CTE program (Arrant, 2011). Educators in vocational programs ask local employers to participate in a board that will help review curriculum, review trends in the profession, discuss capital expenditures, and review outcomes of the program. These partnerships allow for an up-to-date exchange of knowledge and instructors access to the workplace to view first-hand the environment the employers work in. Educators can get students out for tours and give real-life projects that connect them to the industry. Partnerships allow for employers to come into the classroom and further help in the education of students as well. Another benefit of the partnership is the potential for financial help. Schools have a tight budget for capital equipment purchases and these partnerships can be a way to help offset material needs that can benefit the class. To build a strong advisory committee takes effort but can pay dividends to the instructor in the form of professional advice, mentorship, and classroom support (Biggerstaff, 2016).

In Kent County, the Kent Career Technical Center offers a variety of CTE occupations for students to choose from. Each of these CTE programs has an advisory committee and advisory handbook. Meetings are held twice a year to discuss curriculum, status of the program and industry standards. As a member of the welding advisory committee, I am expected to add
input, participate in discussion, and help guide the instructors to ensure the students success. I do that by opening company doors for tours, work-based learning opportunities, and financial support for additional equipment needs. The school in turn provides the opportunity to work with students and create a pipeline of employees for future growth.

**International Partnerships**

Many European countries have utilized partnerships as a way for students to gain skills for the type of employment needs a company would require. While type of the partnerships can vary based on the country, the desire to have more students in manufacturing is the same. Partnerships can also have a different make up with some having government and community entities participating in the partnership.

In Australia, for example, the government has become involved in a collaborative arrangement with industry and schools to attract students to the industries with gaps to fill (Flynn et al., 2016). In Africa and Malaysia, partnerships are formed to advance their mutual needs that help to preserve a project of public interest (Oviawe, 2018). In Norway and Sweden, the partnerships share in any critical challenges the partners might face through economic ups and down (Rusten & Hermelin, 2017). During downturns in the economy, there can be a lack of apprenticeships or positions available for students (Rusten & Hermelin, 2017). In the United Kingdom, even their academic research is affected by the proportion of projects that industry is involved with (Banal-Estanol et al., 2015). This means, the higher the degree of collaboration, the higher number of research ideas that are generated and potentially publicized (Banal-Estanol et al., 2015). Asian nations have been ramping up their partnerships in order to stay in competition with the United States, however, their studies only show 20% of the collaborations results in tangibles that are industry applicable (Liew et al., 2013). The partnerships struggle to
collaborate due to both parties having different expectations and requirements to meet (Liew et al., 2013).

Germany has a large presence in the world of manufacturing and K-12 partnerships. In high schools, students determine participation in an academic track, one track is geared specifically towards a vocational education where they work on a degree in a specific vocational profession of interest. During this time, students’ study, work, and complete courses in their program of study. They are dual enrolled during this time, finishing core classwork and obtaining an education in the career path they selected. Germany’s program has attracted attention from a number of countries and evaluated to determine if similar concepts can be introduced to get students interested in vocational education (Deissinger, 2015). They purposely choose to allow students to pick their college or career path through a process of exploration and learning that no other country does (Seifried & Wuttke, 2013).

Germany’s partnership with employers has helped to make the exploration process happen. While all vocations could be discussed, for this paper, I will be focusing on the manufacturing portion of Germany’s model. The manufacturing vocations have a reputation that is different than many other countries. In Germany, the manufacturing industry accounts for 40% of all apprenticeships (Steedman, 2010). The dual system, with the involvement of employers, educate students with a high degree of technical and practical competence that ensure relevance in market requirements (Hancke & Coutier, 2013). Students leave the program with professional accreditations that allow them to continue training with an employer to obtain further recognized credentials (Hancke & Coutier, 2013). This allows students to continue to learn, grow, and obtain further financial rewards. Germany has found that the apprenticeship model has overall higher wages and stronger labor market attachment with during the life cycle of the 3-year
apprenticeship, an apprentice can see a 14.1% return and if all cost to the apprentice is eliminated, that return increases to 27.1% (Adda et al., 2006).

Through the German model of partnerships, students get work-based learning opportunities early on, further their education and learn a trade that will offer them a full-time job after graduation. Due to the partnerships, Germany has a low rate of youth unemployment, so companies can advance their manufacturing processes and have more flexibility in their manufacturing strategies (Goebel, 2015). Not only is the education system different in Germany, but so is the perception of manufacturing careers. This is due to the nature of how they educate, train and manage their manufacturing companies, so all generations find value in the careers that are offered (M. Verfuerth, personal communication, 2019).

**College Partnerships**

College and business partnerships have a long history with many offering internships, employment opportunities and project-based learning. Employers in the manufacturing world have utilized college students in a variety of capacities that include summer help, internships and co-op opportunities. Students gain real-world experience while employers get opportunities to work with and hire candidates for their companies. Over the years, various types of partnerships have become part of the college landscape in Michigan and have impacted the way in which high school partnership are created.

In the college setting, partnerships allow students to become engaged with industry personnel. They can ask questions of employers, understand industry requirements, and increase their overall knowledge on careers (Burns et al., 2018). In the higher education world, they do not believe in partnerships that are one-to-one but rather have multiple employers involved, and they collaborate to address educational improvements (Imel, 2001). The partnership can have
benefits for both sides such as cost reductions, collaboration on curriculum and a resource who is an expert in their field (Ivascu et al., 2016). In some industries they will have frequent collaboration to increase their technological abilities even (Freitas et al., 2013). The most effective partnerships are ones where industry is actively involved in improving education (Imel, 2001).

Student not only reap the benefits of partnerships with industry, but they also gain exposure to the careers they are looking to pursue. Students feel the partnerships impact is great. They perceive the internships and projects as making a great impact on learning about the workplace and its culture (Burns et al., 2015). Students are more likely to tell others about the good education and business experience thus reinforcing the partnership to others.

Colleges and industry partnership also present opportunities beyond helping student. The partnerships help to reinforce the work that both areas do. They help to promote a new appreciation for the teaching profession (Kubuota, 1993). This help to overcome the barrier presented when manufacturing feels that training and development might be better suited in the workforce alone and not by education. Without partnerships, it is hard for academics to know the needs of the employers to develop the appropriate curriculum, likewise, without the partnership, industry has little understanding of how academics can contribute to better educating their future employees (Book, 2017).

In Michigan, there are a few documented partnerships that are gaining momentum. The first can be see through the Middle College programs that are happening throughout the state (Michigan Department of Education, 2018). The Michigan Early Middle College program offers students an opportunity to earn a high school diploma and either an associate degree, the Michigan Early Middle College Association (MEMCA) technical certificate or 60 college credits
that can be used at various institutions (Michigan Department of Education, 2018). It is a cost-effective method for students to obtain a college degree or college credits while still in high school and they will finish high school with a 13th year that is spent in the college (Michigan Department of Education, 2018). As noted in the previous text, the Ottawa Area Intermediate School District has a middle college partnership with a local manufacturer and high school that is geared towards manufacturing programs. Several other high schools, like the Kent Intermediate School District, have started middle college programs that allow student to attend a 13th year of high school and graduate with an associated degree in a manufacturing related career. This school district worked with local employers to establish what was necessary to graduate students that would be viable members of their organization. Many schools around Michigan have adopted middle college programs but not all have manufacturing related careers. The number of programs across Michigan increased from 67 in 2014-2015 to 142 in 2018-2019 and range from a general associates degree, business, healthcare, manufacturing, or any number of programs agreed upon by the high school and the secondary institution (Michigan Department of Education, 2018).

The Southeast side of Michigan started the Michigan Advanced Technician Training, or MAT2 program, which has similarities to the German model but is only geared towards college students. This is a partnership between college and business’ where businesses will pay for the college tuition of the student while they will also work in that employer’s workforce. The time they work can be full or part-time depending on the organizations requirement and what the student/employee is looking for. This model allows for students to work and learn at the same time, gain experiences in the field they are interested all while getting free tuition. The state is now offering this option on the westside of the state, and they are looking at this as a potential
best practice. If this program is successful this can lead to a way for others to implement an industry-driven, competency-based education that works with the stakeholder expectations (Baumann et al., 2014).

Another program is the Advanced Manufacturing Partnership, or AMP program, located in Grand Rapids, MI. The program was built with manufacturing that were struggling to find machinists to add to their workforce. This program has some similarities to the MAT2 program in that employers and educators work towards finding student and they work as well as go to school during the program. These students can be out of high school or could be coming out of the employer’s workforce. The employers determine the candidate, they apply to the college for the program and if accepted for both the employer will pay for the education of the student. That students will also be employed with that company working hours that the two agree upon. This AMP program allows student to obtain an associate degree, but students can further their education through other tracks the school has set up for them (Grand Rapids Community College, n.d.).

Another way that employers participate in college partnerships is by being on advisory committees. A requirement of technical colleges is to have advisory committees to help to define curriculum, discuss best practice, and discuss industry trend (Frala, 2006). These partnerships do not just offer opportunities for financial support but rather look at the holistic view of what is necessary to graduate students in these degrees that will be a benefit to the economy and employers. This is a way to keep the educational system on top of the latest trends in technology, trends, and outlook for employment. Employers give input but know that the output should allow for them to continue their business for years to come. Educators know they get the latest insights and will graduate student that employers are looking for (Frala, 2006).
Lastly, some partnership cross state line like the Advanced Manufacturing Technical Education Collaboration (AMTEC). This partnership encompasses community and technical college leaders as well as automotive manufacturing companies from Michigan, Ohio, Tennessee, and Kentucky to increase training and educational opportunities for a wide variety of occupations needed in the manufacturing companies. Since its inception in 2005, the partnership works together to build curriculum and pathways with certified assessments. The partnership has created on-line curriculum and worked with other partners to create an AMTEC simulator for employers to have on site and allow for limitless use and development. This type of cross-sector collaborations keeps the end in mind with understanding the design the process, structures, and interactions to achieve the desired outcomes (Breiyson et al., 2006).

**Chapter 2 Closure**

Manufacturing is not able to find the skills needs in today’s potential workforce to produce the products needed for the future of the Michigan economy. However, many partnerships have development out of need and necessity across various countries and states around the world to develop this type of talent. From K-12 to college the industry partnership has created new ways to help meet the needs of the future workforce. While the reason to collaborate might be different across various venues, the outcome of helping to create necessary learning opportunities is not.
CHAPTER 3

METHODOLOGY

Introduction

The construct of this study seeks to understand how the activities within a K-12 and manufacturing partnerships influence a student’s decision to pursue a career in manufacturing. In specific, this research focuses on one partnership that has been formed by a Midwestern high school and local manufacturers called the Manufacturing and Engineering Partnership Program (MEPP). The questions to be answered are:

1. What can we learn from students enrolled in a K-12 and manufacturing partnership program?
2. How and to what extent have students been influenced by the activities in a partnership program?
3. What activities contribute most to influencing the students in this program?

Ultimately, this body of research tried to understand what extent, if at all, this manufacturing partnership plays in the decision-making process for high school students interested in careers in manufacturing.

Methods Overview

A qualitative instrumental case study methodology was used to understand how the MEPP partnership between industry and the K-12 education influences a student’s decision to pursue a career in manufacturing. Case study designs have been used in education and business to understand complex issues in a real-world setting (Harrison et al., 2017). According to Stake (1995), an instrumental case is best aligned with a qualitative study where the researcher and participants pay a role in reconstructing the experience. The results of this study provide a
comprehensive description of the students and partnership to allow for understanding of the phenomenon happening through this partnership.

A case study is commonly used to collect in-depth data in a natural setting where the researcher has little or no control over the events and there is a real-life context (Center for Innovation and Research, 2020). This research was done in a high school environment where manufacturing partners play a role in a specific class and program to try to promote manufacturing related careers. Case studies are commonly used in an educational setting with a goal of formatting a hypothesis for future research (Center for Innovation and Research, 2020). The questions asked allowed K-12 and manufacturing partnerships to further explore how their students are influenced by the activities they provide to better evaluate the effectiveness of their programs.

Data for this case study was collected utilizing an interview methodology. Qualitative research is used for various reasons, to answer a question, collect evidence, produce findings that were not determined in advance or produce findings that are applicable beyond the immediate boundaries of the study (Mack et al., 2005). Sixteen students who had participated in the MEPP program over the last three years were interviewed. Eight of these students had completed the full MEPP program and the other eight completed the MEPP class, but did not enroll for the full MEPP program. The semi-structured interview responses were collected and analyzed to find themes and connections between student responses. Using semi-structured interviews allowed for a flexible interview protocol with follow-up questions and additional probes as well as an exploration of the participants’ thoughts and feelings on a topic (DeJonckheere & Vaughn, 2019).
The interview questions were designed to understand if the MEPP program influenced the students career decision making. Specific questions such as:

1. What led you to a part of the MEPP program?
2. How, if at all, did the MEPP partnership influence your career choice decision?
3. Do you remember any specific activities in the program that made you interested in manufacturing careers? If yes, what were those activities and what about them resonate with you?

This line of questioning allowed students of this program to recall their lived experiences in the class and discuss what aspects influenced their career decision making. The interview allowed them the ability to be open about what is the least and most effective parts of the MEPP program. A quality interview is produced if the researcher can encourage participants to reveal their experience and have a volume of confessed information (Au, 2019). A full representation of all the interview questions can be found in Appendix A.

**Research Design, Approach and Rationale**

This study analyzed students who had participated in the MEPP program based on data collected through interviews. The responses were collected and analyzed to find connections between students’ responses. Approximately, 25 students participated in the MEPP class each year, but not all apply to participate in the full MEPP program. The MEPP program has been in existence for eight years. To understand the full extent of the MEPP phenomenon, a purposeful selection of 16 students from the last five graduating classes was used to collect the information from. Within these 16 students, eight are students who completed the full partnership program whereas the other eight chose to not enroll in the complete program. I interviewed students who did and did not apply to the full program to get a complete understanding of student experience.
This also allowed for a reader to hear perspectives on manufacturing futures from both students who take the class but decide to not move forward with company interviews and those that do.

To achieve the goal of 16 interviews, records were received from the high school on the last five graduating classes. Students were reached via the contact information given and a subscription to Peoplefinder was obtained to help locate those who had moved or changed contact information since high school. Virtual interviews were scheduled that lasted 30-60 minutes.

Non-formal interviews were also completed with the instructor for the class, the counselor assigned to these program, and individuals from three partner companies. These non-student interviews provided a better understanding of the broader context of what they see regarding MEPP activities. Gaining knowledge and insight from the full scope of participants in the program added understanding to how this program influences students.

**Population, Sample and Setting**

For the purposes of this research, a Midwestern high school partnership program was the focus. A high school created a program with the help of employers, as a means of creating student interest in manufacturing careers. An instrumental case study methodology was used to understand the MEPP program. A purposeful selection of students from the last five graduating class of the MEPP program was used to collect the information. Purposeful sampling is used when an author does not want to screen all people to gain a comprehensive, single answer but rather examine the complexity of different ideas offered by the group of people selected (Benoot et al., 2016). By using a purposeful sampling, a selection of information-rich cases related to the phenomenon of interest can be made (Palinkas et al., 2015). A sampling of eight students who
completed the partnership program and eight students who made the decision to not apply for the full program were interviewed.

Data collection consisted of MEPP students who graduated from the high school and the partnership program. These students ranged in age, but all have been active participants in the program and still lived in the state of Michigan. The high school is in a rural, small town, outside of Grand Rapids, Michigan. The school is surrounded by agriculture and primarily middle class, working families. The sample size was 16 students who participated in a thirty to sixty-minute interview. The research goals of understanding the influence of the MEPP partnership program was reviewed and permission to have access to the partnership committee and students involved was obtained. Due to the sensitivity of accessing student information, I worked in conjunction with advisors and staff to start the contact process with graduates. Peoplefinder was also utilized for an additional location feature. This allowed the ability to locate students who may have moved or changed their addresses from what the high school has on file. The e-mail recruitment script is in Appendix A.

I, as the researcher, wanted to understand how the activities in a partnership program influence the students to pursue a career in manufacturing. Using open-ended, semi-structured interviews, provided students the opportunity to give as much detail as they feel comfortable with. According to Marshall and Rossman (2006), a researcher using in-depth interviews as the sole way of gathering data, should demonstrated through the conceptual framework the purpose of the study and describe the participants perspectives. The understanding of student perspectives on the program is the paramount focus of the research. Creswell and Poth (2018) stated that for a case study to have proper data collection we will need to take extensive notes and use proper transcription.
To ensure the data collected is credible, a member checking process was used. Member checking is a validation tool where the responses are returned to the interviewee to check for accuracy and that the results resonate with their experiences (Birt et al., 2016). Returning of the responses happened via e-mail after a transcript was created. A proper analysis of the interviews is an important validation technique used to ensure trustworthiness in qualitative research (Birt et al., 2016). Validity was provided through coding and themes in different sources of data that are collected (Creswell & Poth, 2018). Saldana (2021) states coding is a process of analyzing data by taking it apart and putting it together in a meaningful way. When reading the data, a descriptive code that relates to the research questions and captures the essence of the content was used (Cunningham, 2004). The data was cross examined to determine any overlapping of information. The objective was to produce a meaningful account that addresses key aspects of the research questions and produce an account that is systematic and transparent for the reader (Spencer et al., 2014).

**Confidentiality of Subjects**

To achieve confidentiality for the students, proper names or any identifiable information were not used when discussing the outcomes in this research paper. Students knew from the beginning of the interview that anything said would be kept confidential and they would have the opportunity to review the interview notes to ensure accuracy of the information. This was done to help build trust as well as ensure they understand that all information would be kept separate from the person. The Human Subjects in Research Board (HSIRB) has a compliance list and bill of rights that was also discussed to add additional assurance that they understood the importance of confidentiality in the work that was produced.
It was noted that the data is coming from one specific partnership program and people within that partnership may try to determine who has said what within the paper itself. To keep the subjects confidential the “dominant approach” was utilized. This approach has three parts for which the researcher made sure that the interviewees are kept anonymous, in the data collection, data cleaning, and in dissemination of the research results areas (Kaiser, 2009). This required that throughout the research, no identifiable information is given to the readers. This helps to make sure anyone reading the research would not have any identifiers. However, there is still a potential that people close to an interviewee could determine who the interviewee is (Kaiser, 2009). As the researcher, I ensured all possible identifiers were extracted to the ability possible.

**Data Collection Methods**

For this qualitative case study, an open-ended, semi-structured interview was held with each participant. This type of interview provided a mix of open and close ended questions which allowed for asking additional follow up questions as the interview was in process (Newcomer et al., 2015). Semi-structured interviews allowed the conversation to be more fluid and be able to ask how or why questions to further investigate answers that have been given by the interviewee (Newcomer et al., 2015). Due to the goal of understanding to what extent the activities in the partnership program influenced students, semi-structured interview allowed for further in-depth discussion based on how they might answer the questions.

To keep consistent, each interview was completed in one of two methods. Due to current COVID-19 pandemic restrictions, the first method was through a phone interview. The second method was through a virtual platform such as Webex. As suggested by Creswell (2009), an interview protocol was observed. All interviews were recorded for accuracy of the data. Interviewees were treated in a way where the participants knew their views are valuable and
useful (Marshall & Rossman, 2006). The participants received an in-depth understanding of the importance of this research for future of the MEPP partnership and programming. In the Appendix B, a full list of questions such as the samples below shows what was asked of each participant:

1. Do you remember any specific activities in the program that made you interested in manufacturing careers? If yes, what were those activities and what about them resonated with you?
2. When thinking about your experience, what aspects of the MEPP program should be improved?
3. How did your participation in the MEPP program influence your perception on careers in manufacturing?
   a. Where was the program most effective in influencing that perception?
   b. Where was the program least effective in influencing that perception?

**Data Analysis**

After the interviews, I transcribed the recording using a methodical process that ensures all information is extracted properly. Then I utilized member checking which is returning the extracted data and having the participants review for accuracy (Creswell & Poth, 2018). Handling the information obtained through these interviews required ethics and coding to also help in obtaining trustworthiness in the data. Regarding ethics, I ensured protection of the participations by making sure no identifiable data is present when disclosing the comprehensive findings to the participants (Creswell & Poth, 2018). The results of the findings and a copy of the final dissertation are available for any participant to read. To test validity, a coding system was created. According to Creswell and Poth (2018), data is coded into meaningful themes and
categories such as uncertainty, social drivers, and outside influences. I can then have those themes and categories evaluated by using similar characteristics presented in the data. Creswell and Poth (2018) suggest make sure when coding that the codes are significant, complete, consider alternative perspectives as well as, composed in an engaging manner. The data was presented thoroughly but also accurately by having students be able to read over the outcomes of the interview and verify that what has been noted correctly portrays what they were trying to say. This type of analysis helped with validity for the readers as well as build trust with the interviewees.

**Trustworthiness**

To establish trustworthiness, the I started by establishing an open dialogue with the interviewees, so they understood the full extent of the research. In qualitative research, the goal is to understand a phenomenon by examining the experiences of the participants, therefore the researcher will need to be honest and accurate (Kornbluh, 2015). By understanding the research goals, the interviews with the MEPP students were as detailed and informed as possible. Each interview was recorded to ensure all information is captured completely. It is understood that researchers are influenced by their subjects’ lived experiences, and as the researcher, I can incorporate member checking to validate what is heard as well as build trust into the writing is important (Kornbluh, 2015). When the interviews were completed, I then provided the students with a copy of that transcript. By having the students review the transcripts, check, and confirm the results, reduced the potential for bias (Birt et al., 2016).

**Reflections on My Identity**

I had an inside understanding of the MEPP program due to working for one of the partner companies, DeWys Manufacturing, Inc. DeWys was a founding member of the organization and
has been a part of the governing board that makes policy decisions. While I no longer attend the quarterly meetings, there is continued support in the functions and activities surrounding the partnership. I am still on all the e-mails, minute distribution and requests that the school makes of the employers. Due to this knowledge, I may have bias and need to standardize the interview interaction (Pannuci et al., 2010). I needed to make sure to address the credibility of the results through the thoroughness of the notes and by being able to differentiate between what is actually said versus what I interpreted as being said (Devers & Frankel, 2000). I needed to set standard questions and be in a standard setting. Lastly, as the researcher, I also utilized a coding software system to ensure not to add any additional bias to the research.

It is important to address for the readers about having first-hand knowledge of the programs. This connection to the program allowed for easier access to students who have graduated from the program and means that students might feel they needed to talk due to these connections. The first-hand knowledge might also mean that readers assume bias throughout the paper. Validation of the research and journaling any of my thoughts before and after an interview can help to identify any unrecognized thoughts and feelings on the topics that I am trying to understand (Chenail, 2011). All while continuously working to ensure I kept the roles separate. It is understood that by discussing my reflexivity, that it can enhance the body of work and help to better evaluate how the I can help or hinder the body of work and find ways to better present the data (Berger, 2015).

**Limitations and Delimitations**

There are a few limitations to the research, the first which is that the MEPP partnership program is only one example. There are differences in set-up and formation of partnerships in other types of school programs. The students in the K-12 school in this case study have a similar
demographics and are in a smaller community. There will be K-12 schools with partnerships in larger communities with more options. Lastly, participants may not completely or accurately remember their experiences in the MEPP partnership and therefore may not be as insightful for the discussion.

There are also a few delimitations to the research. One of them is the size of the student population I interviewed; it may be possible to get a larger sample population from more graduating class. As the researcher, I will constantly evaluate whether saturation has been achieved. Lastly, I did not interview students who are not able to join in the MEPP program but might have been interested. The MEPP class allows for up to 30 students to participate. It will not be understood whether they felt the program could have influenced them to get into manufacturing careers.

**Chapter 3 Closure**

In seeking to understand what the student experience was like in the MEPP partnership program at a Midwestern high school, a methodical instrumental case study was created to provide for an in-depth interview process and proper analysis of information. By using the list of student contact information, the high school provided along with an on-line Peoplefinder search tool, I was able to find students from the last five graduating years. Through the utilization of a semi-structured interview process, we can understand the responses to the overarching question on what we learned about the experiences of students who enroll in a partnership program. Once completed, the information was transposed and validated through member checking. This helped to ensure accurate information for the readers and that students felt confident in the transcribed interview. Through proper coding, themes were produced to help inform the reader on the
information obtained through this study and the way in which it can be replicated for future research studies.
CHAPTER 4

RESULTS

The purpose of this research is to understand how the activities in an industry and high school partnership program influence student career interests. The research used a purposive sampling of 16 students who had been involved in the program and graduated from this high school from within the last five graduating classes, including the years 2015-2020. The research included two subgroups, one being eight students who participated in the MEPP class only, and the other subgroup being eight students who completed the class as well as applied for a summer internship opportunity. Semi-structured interviews were utilized and touched on areas such as what the experiences were like in the partnership program as well as what impact the partnership program activities had on students’ career decisions making.

Interviews with three business partners as well as the instructor and advisor for the program were also performed. Knowledge was gained regarding what these participants perceived occurring with the MEPP activities. These interviews further informed the research about how the MEPP program influencing students.

The objective of the research was to address the following research questions:

1. What can we learn from students enrolled in a K-12 and manufacturing partnership program?

2. How or to what extent have students been influenced by the activities in a partnership program?

3. What activities contribute most to influencing the students in this program?

The themes from the research questions will be documented in the sections that follow.
Student Related Findings

A table has been put together outlining demographic information pertaining to the 16 students interviewed for this program. Table 1, titled MEPP Student Demographic Information gives an understanding of what year they graduated, what occupations they had focused on prior to and after the class and whether they went into a manufacturing related career.

Table 1

<table>
<thead>
<tr>
<th>Demographics</th>
<th>Class and Internship</th>
<th>Class Only</th>
<th>Year Graduated</th>
<th>Career Path at Start of Class</th>
<th>Current Career Path</th>
<th>Going Into Manufacturing</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>X</td>
<td></td>
<td>2018</td>
<td>Engineering</td>
<td>Mechanical Engineering</td>
<td>Y</td>
</tr>
<tr>
<td>F2</td>
<td>X</td>
<td></td>
<td>2018</td>
<td>CAD/Undecided</td>
<td>Design Engineering Counselor</td>
<td>Y</td>
</tr>
<tr>
<td>F3</td>
<td>X</td>
<td></td>
<td>2015</td>
<td>Engineering/ CAD/Design</td>
<td>Counseling</td>
<td>N</td>
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<tr>
<td>F4</td>
<td>X</td>
<td></td>
<td>2017</td>
<td>CAD/Design/ Undecided</td>
<td>Product Design Engineering</td>
<td>Y</td>
</tr>
<tr>
<td>F5</td>
<td>X</td>
<td></td>
<td>2015</td>
<td>Mechanical or Design Engineering/ Undecided</td>
<td>Machine Builder</td>
<td>Y</td>
</tr>
<tr>
<td>F6</td>
<td>X</td>
<td></td>
<td>2020</td>
<td>Engineering</td>
<td>Packaging Engineer</td>
<td>Y</td>
</tr>
<tr>
<td>F7</td>
<td>X</td>
<td></td>
<td>2019</td>
<td>CNC Machinist/ Engineer</td>
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<tr>
<td>F8</td>
<td>X</td>
<td></td>
<td>2018</td>
<td>Diesel Technician</td>
<td>Tool Room Technician</td>
<td>Y</td>
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<tr>
<td>CO1</td>
<td>X</td>
<td></td>
<td>2017</td>
<td>Engineering</td>
<td>Plastics Engineering</td>
<td>Y</td>
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<tr>
<td>CO2</td>
<td>X</td>
<td></td>
<td>2018</td>
<td>Chemical Engineering/ Geology/Welding</td>
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<tr>
<td>CO3</td>
<td>X</td>
<td></td>
<td>2019</td>
<td>Engineering/ CAD/HVAC</td>
<td>Agriculture</td>
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<tr>
<td>CO4</td>
<td>X</td>
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<td>CO5</td>
<td>X</td>
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<td>Engineering/ Undecided</td>
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<td>CO6</td>
<td>X</td>
<td></td>
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<tr>
<td>CO7</td>
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<td></td>
<td>2020</td>
<td>CAD</td>
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<td>CO8</td>
<td>X</td>
<td></td>
<td>2015</td>
<td>Engineering</td>
<td>Structural Engineer</td>
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</table>
The following outlines the results of the 16 interviews with students from the Manufacturing and Engineering Partnership program. To keep the student information confidential, they are coded with a number and letter, with the letter representing whether a student completed the full program (F), or the class only (CO). Themes evolved during the process of interviewing and documented conversation. One theme that arises out of the demographic data is not discussed in the interview process, shows students who complete the full program are more likely to go into a manufacturing related career. Out of the 16 students interviewed, only two out of the eight students who attended the full program did not go into a manufacturing related career whereas only two out of the eight who attended the class only went into a manufacturing related career.

Table 2 titled Interview Themes has been inserted to further understand what student agreed with the themes reflected in the interview process.

Table 2

*Interview Themes*

<table>
<thead>
<tr>
<th>Themes</th>
<th>F1</th>
<th>F2</th>
<th>F3</th>
<th>F4</th>
<th>F5</th>
<th>F6</th>
<th>F7</th>
<th>F8</th>
<th>CO1</th>
<th>CO2</th>
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<th>CO4</th>
<th>CO5</th>
<th>CO6</th>
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<tr>
<td>1.2 Perception</td>
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<td>X</td>
<td>X</td>
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</tr>
</tbody>
</table>
Analysis of Themes

Research Question 1: What can we learn from students enrolled in a K-12 and manufacturing partnership program?

The first research question focused on what could be learned from students enrolled in a K-12 and manufacturing partnership program. Four themes emerged based on the analysis of the student interviews: (1.1) teacher or class influencer existed; (1.2) the initial perception of manufacturing by most students is primarily negative; (1.3) the MEPP program allowed most students to see manufacturing differently; and (1.4) all students found the MEPP program beneficial. These themes are discussed, along with example student quotes, in the following sections.

Theme 1.1: Teacher or Class Influencer Existed

The first question asked of each student was, what led you to be a part of the MEPP program, and 13 of the 16 students mentioned a specific instructor name who suggested they get into the program or mentioned being interested in Engineering or CAD from a class in high school. The high school offers four levels of CAD classes and two levels of Engineering all taught by instructors affiliated with the MEPP program. This means that the vast majority of those students entering this program were primarily influenced by a teacher from a CAD or Engineering class or by taking a CAD or Engineering course at the high school. The MEPP program also provides one woods, one metals and two plastic manufacturing courses that are all taught by instructors affiliated with the MEPP program. This high school is one of the very few area high schools that offers these courses on their campus, instead of sending their students to an intermediate school district for skill trades education.

For example, CO2 stated, “I was a part of the engineering class and the teacher suggested MEPP since I was interested in engineering.” CO5 said, “it was recommended due to CAD class
and my interest in engineering.” CO7 said, “[I] took woods, plastics and metals classes. Liked the atmosphere and took CAD class. Instructor told me about it.” F2 noted that, “he wanted to do something in CAD field and teacher told him.” F3 said, “I took a CAD class at school and a partner company present.” F6 said he, “had a good teacher from the manufacturing world and how important it was to have someone who knows manufacturing.” F7 explained that “an instructor and the advisor knew he was geared for this class.” F8 took the engineering courses and said, “the teacher encouraged her to join.”

**Theme 1.2: The Initial Perception of Manufacturing is Primarily Negative by Most Students**

While not all students held a negative perception of manufacturing, the outcomes from the interviews show nine of the 16 students held negative views prior to starting the program.

For example, student F1 said that his perception of manufacturing was “dark and work people dread.” F6 said he heard, “manufacturing is a dirty and hot place with not complex work to do.” Student F5 had thought that “kids shouldn’t work in dirty old shops and his parents supported that idea of manufacturing.” F8 had a vision of manufacturing as being a place where there was only “mass production of something.” Student CO3 said, “[I] thought manufacturing was a dark workshop with not great working conditions.” CO5 stated that upon entering the program he did not think that manufacturing was “meaningful work and that it did not require much skill.” Student CO7 thought manufacturing work was where you did the “same thing over and over again.” CO6 was certain what to expect when it came to his perception of manufacturing, but he thought it was a “boring job” to have.

**Theme 1.3: The MEPP Program Allowed Most Students to See Manufacturing Differently**

The negative perception held regarding manufacturing was changed due to the experiences the students have in the program. While understanding that not all students will
ultimately desire a career in manufacturing, 13 students did find value in seeing manufacturing through the class experiences.

For example, student F3 said the MEPP program “gives more information and allows you to see what manufacturing is verses what parents, family or friends say.” F2 said that class “informed him and allowed him to “see what [manufacturing] truly is.” F5 said that he, “found out there was a lot more to manufacturing than what he thought, it is cleaner and not so dark and dingy.” F6 said, “the places are clean, air conditioned and people were professional in a good working environment.” Student F7 said the MEPP classed changed his perception, manufacturing is “not the old factory your grandpa worked in.” Student F8 stated, “half of high school students have no idea, they go to college and get a job. This program shows other options and ways to be successful and highly paid.” Student CO3 said, “a lot of people have a negative perspective of manufacturing; this program is not like anything else and give real-life exposure.” CO6 said it “helped him respect the career option more” as saw manufacturing as lazier job option. Student CO5 said, “students don’t see opportunities in manufacturing, only way to get a good career is to go to college. MEPP is valuable in getting information on careers that people don’t think about.”

**Theme 1.4: All Students Found the MEPP Program Beneficial**

All 16 students felt the MEPP program was beneficial. While some students did not choose to go on to apply for the full MEPP program, nor did all of them choose to go into manufacturing careers, all noted that they felt it is beneficial to students. Students like F2 said, “it is beneficial to anyone on the fence. It shows you everything from both sides.” F3 said, “regardless of whether you stay in it (manufacturing), it helps with the decision of what you want and not want to do.” Students F6 and F8 mentioned that is allows students to explore
manufacturing and both mentioned the program shows something other than college being the only path. F6 said, “he always liked building stuff and learned he could make a career out of it.” He went on to mention he learned, “you don’t have to go to a four-year university.” F8 said, “MEPP is a good opportunity to explore whether to go to school or not. If someone is not sure what to do, MEPP gets you a foot in the door to explore.” CO1 said, “MEPP is beneficial, there are good manufacturing jobs, and they need good skilled people. If students are not exposed, how do they know?” CO2 and CO5 both mentioned that they do not think the trades are mentioned enough and this program allow students to get information on careers they might not otherwise think about. CO2 said, “I don’t think trades are encouraged enough, no one goes into it.” CO5 said, “a lot of students don’t see manufacturing opportunities. Only way to get a good career is to go to college. Programs like this give information to decide on a career in manufacturing.” CO6 said, “not many people get to experience manufacturing” but he went on to state that “MEPP gives firsthand experiences that are eye openers.” CO8 said “when in high school and trying to decide what to do can be daunting. MEPP helps to figure out what you like and don’t like.”

**Research Question 2: How have students been influenced by the activities in a partnership program?**

The second research question focused on how these students were influenced by the activities in a partnership program. Analysis of data related to this question produced two themes: (2.1) the activities in the program help to give most students exposure; and (2.2) the activities allowed most students to understand other career options. These themes, along with example student quotes, are further detailed in the following sections.

**Theme 2.1: Activities in the Program Help Give Most Students Exposure**
The foremost idea presented from asking students about how the activities influenced them was the discussion around exposure and experience. Thirteen students mentioned how the activities gave a better understanding of careers and opportunities manufacturing offered. For example, F5 stated, “he did not realize the jobs that could work with his hands. He helped him to realize he did not want to sit at a desk.” F6 noted that the partnership “gave him exposure to manufacturing, what they made and what a manufacturing career would be like.” F8 said by taking the class it “opened his eyes to manufacturing that he had never been exposed too” and went on to mention all the various career paths he learned about through the MEPP partners. CO1 said the partnership exposed him to better companies in West Michigan and broadened his horizons on subdivisions of engineering. CO3 stated, “that he was initially interested in the medical field but due to his CAD class and participating in the MEPP program, he to found out about the technical trades and then determined medical was not for him.” CO8 said the activities led her to work for one of the partners. That opportunity helped her onto the path the engineering career field.

**Theme 2.2: Activities Allowed Most Students to Understand Other Career Options**

During the interviews, 14 of the students touched on how the activities showed alternative career options to what was presented to them prior to taking the MEPP class. For example, CO1 stated that “lots of kids are hammered to go to college. MEPP gives options and insights.” CO3 believes a lot of people have a negative perspective of manufacturing careers and the MEPP program gives “new interest and shows you do not always need a college degree.” CO5 said, “a lot of students do not see opportunities. Only way to get a good career is to go to college. Programs like this gives information to decide on a career in manufacturing.” CO6 felt
that a lot of people in class did not start out being interested in manufacturing but seeing industries and realizing they will help with their futures changed that.

From the students who completed the full program, F2 stated that the MEPP class is responsible for what he is doing today because of hearing from the companies and understanding occupations. F3 said, “you get more information, hands on exposure and see what manufacturing is verses what parents, family or friends say.” F7 believes the MEPP class is good for learning about manufacturing. It puts out facts and does not hide anything which allows students to make more informed decisions. F8 was exposed to manufacturing due to MEPP and said, “it is an absolute shame that there are not more schools that offer programs like MEPP. How do you get experiences otherwise?”

**Research Question 3: What activities contribute most to influencing the students in this program?**

The third question focused on what activities influenced the student while in the MEPP program. There are four main themes that resonated from the interviews with the students: (3.1) the tours were very beneficial to all students; (3.2) the company presentations were memorable for many students; (3.3) the interviews and job shadows with MEPP partners were helpful to many; (3.4) the in-class group projects had an impact on close to half of the students; (3.5) activities in the MEPP program are in general valuable regardless of future career. These themes are further discussed in the following paragraphs.

**Theme 3.1: The Tours were Very Beneficial to All Students**

As part of the program, students tour various MEPP partners during their class. All 16 students discussed the impact of touring the partner companies. CO2 said that she toured 2 or 3 different companies, “where you could see where you could work, what you would do or how you would grow.” CO5 said that the tours “were helpful, never stepped into manufacturing. I
could see what the environment was like.” CO6 said that for him, “the touring and visits were the important part. Pictures only go so far.” CO8 mentioned how “cool” it was to see everything put together. She went on to say that the tours allowed her to “see what you are using and the purpose.” F2 talked specifically about a partner company that by seeing their engineering room and then seeing the manufacturing side of the business, he was able to see the actual product being made. “They make car parts, and it is real.” F5 said “touring and visiting is the important part. Pictures only go so far.”

Students that took the class only or participated in the full MEPP program both expressed that touring a variety of companies was even more important due to the different manufacturing processes they were able to show students. F1 mentioned the “wide variety of manufacturing” that was he was able to see through the tours. F5 mentioned touring different jobs at the partner companies that allowed him to see “different parts of industry.” CO2 said she had “two or three different tours” which allowed her to see the variety of “where she could work or what you could do or grow.” CO5 mentioned that he toured five or six different companies which allowed him to “see different sides of manufacturing.”

**Theme 3.2: The Company Presentations were Memorable for Students**

The MEPP class requires all partner companies to present to the class about their industry and what careers they offer. Eight of the students discussed the presentations as being an important activity. CO6 along with many other students, specifically mentioned that the partner presentations as an activity they remember from the program. They discussed hearing information about the industries and gaining more knowledge on manufacturing. CO5 said the tours, “informed students about what goes into a career.” CO8 mentioned that presentation “had different representatives from the company” come in and that this helps “to understand what you
would do day to day.” F3 stated that someone who graduated from the MEPP program went to work for one of the partner companies. That student came in and talked about what they did, and she remembered thinking that she wanted to do the same thing. F8 said, “it helps that partners will dedicate time to present in class and show manufacturing process. Companies take time to invest in people and school, show everyone what it is as an industry.” F2 noted that having different companies come in was beneficial. “If on fence, sets you straight.”

**Theme 3.3: The Interviews and Job Shadowing with MEPP Partners were Helpful for Many.**

Eight students, whether they went into manufacturing or not, reflected on how the interviews themselves played an important role. More about these conversations will be in theme #5. F3 said her job shadow through the MEPP program is where she ended up working at. F4 said “the interviews-built networking and connections” for him. F5 mentioned that his job shadow through MEPP allowed him to work alongside a builder and then a designer so he was able to “see different parts of industry.” Student CO4 discussed how the interviewing helped him as he was able to “interview with different people” and allowed to get “feedback and ask questions” from the people he was being interviewed by. He said the interviews were a “great experience” for him. CO6 talked about building up her resume and cover letter then how she had practice interviews with companies that were graded. CO7 talked about how the companies could interview students and call them back for positions. He went on to mention how the program “helped put your name out there” to various partners.

**Theme 3.4: The In-Class Group Projects had an Impact on Nearly Half the Students.**

The instructor for the class takes students through a variety of manufacturing related class projects. Seven students took time during the interviews to reflect on the projects and specific activities that impacted them in that class. F2 reflected on team building was “huge” for him.
“Gets you thinking differently and working with different people.” He discussed a specific assembly line project and how much faster it went when others chipped in. F6 enjoyed the 5S and lean manufacturing activities. He said, “you need to do something efficiently and that correlated with manufacturing.” He went on to say, it was “stressed in class how much time that can be wasted.” F7 discussed how talking about lean manufacturing and then putting it into real work application was beneficial. He said, “you read about it and then put into use.” CO2 talked about how the lean and 5S project where her team worked on her dad’s shed. She went on to mention how she still uses those concepts today in her geology class. CO5 specifically stated that the lean segment was where he knew he wanted to “get into something like that.” CO7 said that “it was cool to work as a team in that class,” and went on to discuss various projects that he completed.

**Theme 3.5: Activities in MEPP Program are in General Valuable Regardless of Future Career**

It is important to take time to discuss a theme that presented itself while talking about activities with students. The activities played a role but maybe not the role that one would expect in a manufacturing partnership. The theme, even for the six students who decided not to go into a career in manufacturing, is that these activities in the MEPP program were impactful.

From the students who completed the class only, CO2 who is studying geology, the class allowed her to see “that what you [manufacturing] make has an impact on the world.” CO3 went into agriculture said the programs offer “real life experiences” that helped to “change his mind about different careers.” CO5 who is studying to be an athletic trainer talked about how he had “interviewed with different people” and received “feedback and was able to ask questions” which he went on to says was a “great experience.” CO6, who is in school now for physical therapy, said the MEPP class, “is definitely worth the time, you learn a lot of valuable skills.” He
went onto discuss the practice interview and exploring industries as being valuable component. CO7 is in school to be a firefighter, said that not many people get this type of exposure and how “eye-opening” it is to see manufacturing firsthand. It helped him to understand what he did not want to do for his future.

From the students who completed the full program, F3 is now in a counseling program at school but talked about how much students accomplish. They get “a lot of help with resume, cover letter and interview process that is beneficial with any job you go for.” F3 went on to say the class helps “regardless of whether you stay in manufacturing.” F7 is currently farming said the MEPP class is beneficial because it taught “life skill and these skills can be used towards other careers. Helps to make a more informed decision.”

Other Stakeholder Findings

As part of a more comprehensive study, interviews were completed with five other stakeholders of the program. The course instructor, the program advisor, and three business partners for this program were asked a series of semi-structured, open-ended questions that reflect on their time and experiences in the program. The question sought to understand, from their perspective, how the MEPP program and activities within this program, help students to become interested in manufacturing careers. The following sections explain the stakeholder perspectives and in keeping with confidentiality, all names have been removed.

MEPP Instructor and Advisor

The instructor became a part of the MEPP program due to teaching metal, woods, and plastics courses at the high school. He believes:
the MEPP program benefits students because students get to see “real-world” connection with industry partners as getting them out into his “shop” in school does not offer the same perspective and too many students have “no clue” on the real world.

This directly coincided with students’ feedback about the activities being so valuable. The number one theme regarding activities that help students connect with manufacturing were the tours. All 16 students noted how the tours helped them to see manufacturing differently.

Conversations with himself or other faculty members on what the student should do after high school is what he believes draw students into the program. Based on the student interviews, this too is an accurate statement. The number one influencer for why students went into this program was due to talking to instructors like him. Thirteen of the sixteen students discussed this and that explains how students primarily hear about the program. The instructor feels that “something from that MEPP class resonates with the students regarding what they want to do after graduation which is also why they would apply for the full MEPP program.” For those that do not apply, he gave three factors, “students go into a military service, some are comfortable in what they are currently employed in and finally some students do not know what they want to do and do not want to make a decision at this time.”

The instructor felt that students “become interested in manufacturing due to what they hear from other students and from the different business partners that work with the MEPP program.” Activities within the MEPP program help students with the career decision making program by “giving them a better idea on what they want to do with their future, even if it is not in manufacturing.” He said, “activities like the company tours help students to see occupations that help in the career decision making process.” This quote from the instructor also is validated through the interviews with students. All sixteen discussed the benefits of taking this course.
While not all chose to go into a manufacturing related career, it did help all students to think about careers differently.

The instructor still has contact with students who have graduated from the MEPP program and “has never heard anything negative from them about their experience in the program.” He gave an example of one student who decided to pursue college after graduating but completed only a semester before getting hired by a MEPP partner and pursuing a career and education with them. While he believes “programs like MEPP help to fill the gap in getting students interested in manufacturing,” but he “wished more students could get exposed and apply.” Student interviews did reflect on that same comment. Students suggested that more exposure to the MEPP class be given to classmates who were not in one of the MEPP related classes. The perspective is that most students going into the program are already identified from the MEPP related courses.

The advisor for the program also has a background in human resources in a manufacturing setting which is why she became involved in the program. She believes “students get involved in the MEPP class due to promoting it as part of the metals, woods, and plastics programs that they offer at the high school.” She noted identifying students that would be good for this program and the creation of marketing materials has been helpful for getting students interested. As noted in the instructors’ comments, this quote is accurate per the student interviews. The primary way students are introduced to this course is through the other MEPP class and instructors who teach them. She said that “students sign up for the full MEPP program because they found an occupation they are interested in, believe they will have better pay or hopes of getting into a career where the employer will pay for their tuition.” However, she gave three reasons why she felt students do not sign up for the full MEPP program. First is the
students become certain that they do not want to work in manufacturing, the students have another job and does not want to make a change, or the student determines that if the occupation is not engineering or CAD design it is less appealing and would not sign up for the full program. The data from the interviews do show that many students focus on the CAD or Engineering programs. More research regarding “appealing” careers could help to further understand the accuracy of that statement.

There are several aspects of the program that help get students interested in manufacturing careers according to the advisor. She believes that “students get excited to learn they can get paid to have careers in metals, woods, or plastics, which they find “fun.” She said, “the presentation from the partner businesses, the tours and being able to “see themselves” through speakers who look like they are from the same generation help to get students interested in the manufacturing careers.” That advisor believes “these activities the MEPP program provides give students expose and help them in the career decision making process.” This is also an accurate belief based on the student interviews. The activities, even after five years of being out of high school, still resonated with the students. All were easily able to reflect on the ones that helped them in their decision-making process.

The advisor feels confident that students who graduate from the program are “happy they took the class and helped them decide what they wanted to do for a career.” She is, however, “uncertain programs like MEPP help to fill the gap in getting students interested in manufacturing” but noted that “it does not hurt.” She went on to mention that some students leave the program not going into manufacturing, but some come back from school and go to work in manufacturing later. As stated earlier, all sixteen students did find the course beneficial
regardless of what occupation they decided to go into. There is opportunity to further research whether her thoughts on students returning to manufacturing later is true.

**Business Partners**

**Company A**

Company A got involved with the MEPP program at the inception. There had already been a connection due to having children in that school district. The representative from this company believes there are several factors for why students participate in the MEPP program:

…intrigue and finding out what manufacturing is, coming from a rural community with more background in this career field, liking to work with their hands, fearing college or hearing about the program in freshman orientation are some of the major factors.

While students did reflect on that class showing going to college is not the only option, the interviews did not touch on the rest of Company A’s ideas for why students participate.

Students become interested in manufacturing careers by the tours and having the partner companies share what they do or what they need in their employees. He also believes the interview process is beneficial for the students. He noted that from the students he has talked to, the activities in the program help to give students a better picture of manufacturing and therefore help solidify what they want to do career wise. He does believe that the program is has an impact on students noting that it is “amazing how little they know.” This is an accurate assumption based on the student interviews. As the themes outlined, his belief that the tours, partner company presentations and interview process all played an important role. Students were easily able to reflect on one or more of these activities in the interview process.

When explaining why his company is involved in the MEPP program he stated:
that it was not just a way to find new employees but rather as it is a part of their culture to help kids. His organization wants to help with gaining exposure both for his company and for the students. He mentioned the need for students to gain exposure as many have no idea what careers they might be interested in.

**Company B**

Company B also got involved at the inception of the program. The involvement in the program is part of a long-term recruiting strategy of getting students interested in manufacturing careers, not just their company. The culture for this organization revolves around interaction with schools and the community. The representative for this company indicated, “anyone who wants to participate in a partnership like this needs to see it as a long-term investment.” Partnerships are “a good opportunity to build traction around a cause but do not expect a quick turnaround.” This statement aligns with the perception many students have on manufacturing upon entering the MEPP program. The themes show that MEPP allows students to see manufacturing differently yet not all students go into a manufacturing career.

The company believes students get involved with MEPP because “they found their “jam” or something interesting to them.” She believes that the tours and companies going into the classroom make an impact. “MEPP is putting a face to careers in manufacturing.” She went on to state that “students can identify themselves when they see people in manufacturing who are just like them.” Students noted the importance of the activities and the role the manufacturing partners play in giving the exposure to manufacturing careers. One student specifically talked about how a former student spoke to the class and therefor helped that student make a decision on what he wanted to do with his future due to identifying with that person and the career choice he made.
From students she has talked to, this company representative has learned they “love the MEPP instructors” and that students have great things to say about them and the group projects. Her company has hired four students from the program and knows it was a direct link to launching their career in design engineering. She said, “not only do I think the MEPP program fills a gap in getting students interested in manufacturing, I would like to see more programs like MEPP to see more get interested.” The conversation around recreating this program at other schools was also noted by students. As stated by students, how do they know about careers with exploration opportunities like MEPP.

*Company C*

Company C started participating in the MEPP program in 2014 as more of a “commercial” and less personal effort than the other two companies. However, as noted from a representative from this company, “this was an opportunity to showcase what the company or manufacturing does.” The feeling was that without that exposure to companies, the students will just go through high school without thinking about manufacturing careers. He believes that “MEPP is part of the solution for getting students interested in careers in manufacturing.” Students echoed that programs like MEPP show opportunities in manufacturing that they otherwise would not have known about. The exposure to the partner companies in the form of the activities the MEPP program offers further helped them on that exploration.

The Company C representative believes students, “find MEPP less daunting than college.” Students see the financial benefit or a career interest from the MEPP program. The feedback he has received is good regarding the places they visit and the exposure they receive. Company C said, “MEPP allows students to take a first step towards a career through the experiences they have in the program.”
Overall, interviewing the other stakeholders in the MEPP partnership allowed an understanding of the MEPP activities and outcomes from a different vantage point. They give insight as to why education and business partners would provide an opportunity like MEPP to students as well as provide another view of how the activities might impact student career decision making. The interviews also further validate the perspective of the partner companies by correlating the student perspective on what value the MEPP program offers.

**Chapter 4 Closure**

This chapter presents the results of the analysis from the 16 in-depth student interviews, and five interviews with program and company stakeholders used to understand the student experience in the MEPP partnership program. By utilizing a semi-structured interview process, I was able to understand the responses to the overarching question on what can be learned about the experiences of students who enroll in a partnership program. Through proper coding, themes were produced to help inform the reader on the information obtained through this study. Chapter 5 presents the summary of the information learned in this study.
CHAPTER 5

DISCUSSION

The Manufacturing and Engineering Partnership Program (MEPP) is a partnership between a Midwestern high school and local manufacturers. The chapter summarizes the results from my study, provides conclusions and recommendations for additional research, and offers strengths and limitations of the current study. Lastly, this chapter presents implications for future research on K-12 and manufacturing partnerships.

Summary of Findings and Connections to Previous Literature

Previous literature (as covered in Chapter 2) revealed that manufacturing has experienced tremendous growth but, due to the lack of formal technical education and a change in student interested the skilled trades area, there is a shortage of student’s interest in or trained in the skilled trades necessary to fill the positions manufacturing employers have open (Work to Do, 2014). This has led to manufacturers becoming more actively involved in K-12 career and technical education (CTE) partnership (Subramanian & Clark, 2016). These partnerships play a vital role in addressing the challenges and bringing new and real-life resources to the classroom (Subramanian & Clark, 2016). This research sought to further understand how a partnership program, like MEPP, influences students’ career decision-making.

Research Question 1

The first research question focused on what we could learn from the students enrolled in a K-12 and manufacturing partnership program. Four themes emerged based on the analysis of the student interviews: (1.1) teacher or class influencer existed; (1.2) the initial perception of manufacturing is primarily negative by most students; (1.3) the MEPP program allowed most
students to see manufacturing differently; and (1.4) all students found the MEPP program beneficial. These themes are further discussed in the following sections.

Theme 1.1 focused on who or what helped to influence the student to participate in the MEPP program. What is known from the literature review, is that adolescent’s turn to a variety of information sources like parents, peers, guidance counselors and people working in industry (Julien, 2004). Thirteen of the 16 students in the MEPP class had experiences in other CAD or manufacturing related courses and were taught by teachers affiliated with the program. These teachers encouraged them to enroll in the MEPP program, acknowledging such students’ potential interest in a manufacturing related career. This idea/concept/thought/theme (just give it a name – Same with the other ones that just have “This also”) was also confirmed by the instructor for the MEPP class who also believed conversation with him, or other faculty members is what draws students into the program. Some students recommended that this program should be discussed more with other students who might not be a part of a manufacturing related course or opened to students earlier in their high school program.

Themes 1.2 and 1.3 reveal a consistent conversation about the negative stereotype of manufacturing, but that the experiences in the MEPP program opened their eyes to new possibilities. We know from Chapter 2 a Deloitte study, that one-third of the U.S. population would not encourage children to pursue a career in manufacturing (Giffi et al., 2017). The study reported that 77% are worried about security and stability, 70% do not believe manufacturing is a strong career path and 64% believe manufacturing does not pay enough. It is also known that the general perception of society is that manufacturing is a dark, dingy, dead-end place to work with routine activities and little room for meaningful career advancement (Giffi et al., 2017). It was clear through the interview process that students went into the MEPP class with a preconceived
idea of what manufacturing would be like however the activities in the program allowed them to see the manufacturing industry differently. While seven students did not continue into careers in manufacturing, the activities helped to present manufacturing in an improved light. This also coincided with the other stakeholder interviews. Company B mentioned that MEPP puts a face to manufacturing careers and how the activities help students to identify themselves working in those careers.

Theme 1.4 spoke specifically about whether a program like MEPP is beneficial for students to participate in. All 16 interviews believed it was. According to the literature, manufacturing curriculum and educational programs often remain limited for students at the K-12 level (Bosman et al., 2021). This theme shows MEPP provided activities and opportunities for students to explore the manufacturing industry. Exposure for students was a key component to understanding a career field. F2 stated, “if it wasn’t for this program he wouldn’t be in his current career.” F3 said, “regardless of whether you stay in it [manufacturing], it helps with the decision of what you want or not want to do.” F6 talked about how all that is taught is college or trade school, “working in manufacturing is a third category that isn’t taught to kids. Kids that don’t know what to do, MEPP is good for them to experience and take.” CO3 noted that MEPP is “not like anything else. Gives real life experiences.” CO6 said that he:

learned a lot of valuable skills, interview practice and explore industries. If someone isn’t sure about manufacturing, this program is a good way to explore option and make decision on how you see manufacturing on a daily basis. Great program to get foot in door or explore options.

This also is directly linked to conversation with the advisor for the program. In that conversation the counselor believed the activities help to expose students to manufacturing careers. The
advisor went on to suggest the program helps students with the career decision making process. Based on the themes, the thought process is correct.

The literature review outlined career decision making theories that help to shape a person’s decision-making process. John Krumboltz’s social learning theory of career selection talks about learning experiences people have that shape the decision-making process. A component of the social learning theory of career selection looks at associative learning experience where people see careers through observing people in an occupation or through direct experiences (Krumbolz et al., 1976). Krumbolz believed that influencers of career decision making came from positive role models, good observational learning as well as rewards and reinforcements (Bezanson et al., 2016).

Other literature tells us that career exploration involves obtaining a better understanding of the world of work and learn about potential career options. (Porfeli & Lee, 2012). According to Porfeli and Lee (2012), exploration helps youth to answer questions on what kinds of work will be suitable for them by seeking out and learning about careers. The MEPP program offers an opportunity for career exploration and further determining the career path each student will take.

Students enrolled in the MEPP program expressed the benefits of having participated in the partnership program, regardless of what career path they pursued. As noted in research question two, activities in this course that resonated with students were not all specific to the manufacturing industry. Therefore, the students who did not pursue careers in manufacturers were still able to see the benefits for other students to participate.

**Research Question 2**

Research question 2 looked at how students have been influenced by the activities in the MEPP program. In Chapter 2 we learned partnerships creating career exploration activities help
to build bridges for students. However, what extent these explorations effectively drive students’ attitude, behavior and career or work outcomes is unknown (Jiang et al., 2019). The results of research question two help to explain from the student perspective how impactful the activities in the MEPP program were to them.

How have students been influenced by the activities in a partnership program? This question produced two themes (2.1), the activities in the program help to give most student exposure; (2.2); the activities allowed most students to understand other career options. These themes are further discussed in the following sections.

The partnership program activities influenced students through providing exposure and activities that allow for a better understanding of manufacturing. Theme 2.1 revealed that various activities help to expose students. As discussed in research question results, all the students who participate in the program, regardless of future career goals, noted the benefits of the program in exposing students to the manufacturing area and careers within manufacturing. A study from Deloitte shows that 6 in 10 Americans believe that programs directed towards hands-on skill development and industry related activities have best ability to create positive perception and interest in manufacturing (Giffi et al., 2017).

Theme 2.2 focused on how the activities allowed students to understand career options. The activities in the program allowed students to see careers they either did not know about or change their minds on a career direction. Some students noted that the exposure to career options helped them change their minds or feel more confident in the direction they wanted to pursue. Career or vocations exploration involves exploring the world of work to learn about potential career options and to ask the question, what work would be suitable for them (Porfeli & Lee, 2012). According to Porfeli and Lee (2012), the answer to that question comes from work
experiences that are intentionally and unintentionally shared and youth trying to find the answers by seeking out and learning about careers and the extent to which those careers might be suitable for them.

This theme also resonated in the other stakeholder interviews. Company B told the story of a specific conversation that took place with a student where a decision was made due to hearing from a former student who took part in the MEPP program. Students identifies themselves in those careers due to that exposure they have through tours and class presentations.

**Research Question 3**

Research question 3 focused on what activities contribute most to influencing the students in this program. There are four main themes that resonated from the interviews with the students: (3.1) the tours were very beneficial to all students; (3.2) the company presentations were memorable for many students; (3.3) the interviews and job shadows with MEPP partners were helpful to many; (3.4) the in-class group projects had an impact on nearly half the students; (3.5) activities in MEPP are generally valuable regardless of future career. These themes are further discussed in the following paragraphs.

The themes for this third research question all align with the conversation around exposure that permeated throughout the responses to the initial research questions. Career planning and decision-making should start in high school as this is the time to develop career awareness and planning through career exploration opportunities (Lau et al., 2021). Students, regardless of their future career goals, all discussed activities that they remembered and impacted them. Students noted that even though they may not have gone into manufacturing, the interviews and group projects helped to prepare them for the future. Some students mentioned still utilizing the interview and resume building skills they learned. By having career exploration
opportunities, students learn more self-knowledge such as recognizing personal interests, aptitudes, and work-related values (Lau et al., 2021). This message further acknowledges what was learned in Chapter 2 in that without career exploration, students are challenged to make good decisions about college and careers (Kalchik & Oertle, 2010). By engaging students through work-based and hands-on learning, will provide a seamless pathway between high school, college, and the workplace (Revelli, 2018).

These themes were also seen in the other stakeholder interviews. Company A spoke about how he believed students become interested in manufacturing careers due to tours and company presentations. He also went on to discuss how he thought the interview process was beneficial for them. Company C mentioned that exposure to partner companies through the MEPP activities further helps students in the career decision making process. These aligned with what students said during their interview process.

Overall Take-Away

The purpose of this research is to understand how the activities in the Manufacturing and Engineering Partnership program influences the students to pursue a career in manufacturing. Upon examining the results on the 16 interviews, the answer would be yes. In the case of the interviewed students, 14 of the 16 students entered the program planning on a career in a manufacturing field. Currently, 10 of the 16 students are in or still pursuing careers in a manufacturing field. However, as noted previously, 13 of the 16 students had an instructor who taught a MEPP related course who had suggested this program to them, and therefore students already had some tentative interest in a manufacturing related field. This is not to say that the program is not effective in helping students in their career decision making process, but the question was focused on influencing students career decision making. As noted in the future
sections, Recommendations for Future Research and Implications for Partnership leaders, more studies could help to determine if students get into a manufacturing career later in their lifetime. There is also opportunity to determine how to impact student interest in the program from those who do not attend a MEPP related course. This would allow for a better understanding of how impactful the program could truly be in influencing students toward manufacturing careers. However, as explained in the research findings, all 16 students did mention the benefits of this course in the career exploration process. All expressed how the activities did impact them regardless of what profession they choose to focus on.

**Strengths and Limitations of the Present Study**

This research includes a small sample size based on one partnership in a Midwestern community. A study in another location, or with additional participants, could offer greater insights into the student experience. This research also looked at more recent graduating groups of students. Interviewing students who have been away from the program longer could help to understand if the partnership influenced students into returning to a manufacturing career later in life.

**Recommendations for Future Research**

There are four recommendations for future research on K-12 and manufacturing partnership. The first is to research other K-12 partnerships in other areas, and that focus on other manufacturing processes or even one manufacturing sector. This research presented findings on one partnership in a specified Midwestern location, with a focus on metal, woods, and plastic manufacturing. Future research could find new results based on location of the partnership or even the type of manufacturing process or processes they focus on. The research could add to the
depth of knowledge around whether different types of partnership programs have different results.

My second recommendation is to further research students who completed the partnership program more than five years ago. This partnership has been in existence for 10 years. Further research on those students and the career decision making they made upon leaving high school could add to the understanding of whether students return to manufacturing after time away from the program. Little data is kept regarding students upon leaving high school. By connecting to students who left the MEPP program more than five years ago, partnerships could understand the impact a program like this can have on a student after graduation. More information regarding career decision making after graduation could better understand how the program activities and partners offer benefits to the student population later in life by having them make career decision making changes.

The third opportunity is to further analyze the activities in the partnership program. This study looked at what activities influence students but not why. More in depth study of why activities like resume writing or on-site tours can give more meaning to the partners in the program. This could benefit understanding how to increase student interest in manufacturing. By having a more in-depth understanding of how the activities impacting students, the partnerships could find opportunities to increase awareness and improve activities for future students.

Lastly, further research on past students and their outcomes from the program could provide additional understanding on the effects MEPP has had on student career decision making. Additional information supporting the career exploration component of the finding could be found through those discussions. Follow-up with the 16 students in this study could provide additional context to the career decision making process. It is possible that some students
changed career choices and go into a manufacturing related career later in their working careers. This context could further inform partnerships of the value of MEPP like educational programing.

**Implications for Partnership Leaders**

Partnerships have been a staple in education as early as the 20th century (Wood, 2014). Private companies have been collaborating with universities and educational centers to train skill that respond to the company needs (Damo, 2017). Manufacturing industry and K-12 partnerships represent new opportunities to help in the career exploration and career decision making process. When industry, educators and students work together in a partnership, they can see an increase in interest and engagement that leads to enriching the learning environment and better prepare students for their future career (Petrosino et al., 2020).

While in the MEPP program, 10 of the 16 students chose to pursue various types of careers in the manufacturing area after school was completed. However, some students already had thoughts of pursuing a manufacturing related career when applying for the program. As discussed previously, 13 of the 16 students had an instructor who taught a MEPP related course who recommended the class to them. Very few students are either informed of or being recommended to this class from outside influences. Providing more opportunities for students outside of MEPP related classes to understand and apply for the program could be beneficial. As discussed in prior themes, the exposure MEPP provided further helped students to determine if a manufacturing related career is the right opportunity for them. This presents an opportunity for partnerships like this to investigate providing classes like MEPP as an elective course for exploring career opportunities. Career exploration activities like, interviews with employers, job shadowing, and workplace visits and tours are actions that develop, and support career
development ultimately can help students to choose their career goals (National Collaborative on Workforce and Disability for Youth, 2012). Teachers can increase career exploration by helping students to understand the career choice process, guide students and help them to organize their approach (Celik, 2019).

The research affirmed that partnerships are an important part of the student career exploration process. Regardless of whether students went into manufacturing, it is clear through the research that students found a benefit from the program. These benefits were transferable skills that were used by all 16 students regardless of the career choices the students made. It would be beneficial for high schools and business partners to find ways to build additional programming that could help students in the career decision making and exploration process.

**Chapter 5 Closure**

The research set out to understand how the activities in a K-12 and manufacturing partnership program influence career decision making. The research adds to what is known about career decision making and the exploration process by talking to students who participated in one such program. Their insights prove the need for more and stronger partnership. From the perspective of the students, there were multiple activities that were impactful, not all of which were simply connected to a potential career in manufacturing. While 10 of the 16 students currently chose careers in manufacturing, all 16 of the students found the Manufacturing and Engineering Partnership Program to be a beneficial part of their career decision making process. The exposure MEPP presented to students helped them determine a course of action for their future careers. This is an important aspect for all leaders in that student’s responses were positive to the MEPP partnership program regardless of whether they went into a career in
manufacturing. Leaders need to work towards building more career exploration programs that allow students to have hands on opportunities that make better decisions for their futures.

Future research on K-12 and manufacturing partnerships could lead to improving the ability to expose students to careers in manufacturing, further develop content that drives interest in these careers or help build additional career exposure pipelines for other industries. By duplicating the research on K-12 and manufacturing partnerships, more insight can be gained in the career decision making process. Lastly, continued research on this topic can help make a case for why partnerships in the K-12 are impactful to students, educators, and employers in all occupations.
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Appendix A

Email Recruitment Script
Hello,

My name is Laura Schoenborn and I am a doctoral student in the Educational Leadership, Workforce Education and Development department at Western Michigan University. I am inviting you to participate in my research study on students’ experiences in the Manufacturing and Engineering Partnership Program (MEPP) at Coopersville High School.

I am seeking to interview graduates of the MEPP program. I want to understand the influences, in any, the program had on your career selection. I want to hear about your experiences as a student in the MEPP program and welcome the opportunity to hear your story.

If you are interested in participating or would like more information, please send me an e-mail at laura.s.schoenborn@wmich.edu. Participation in this study is voluntary and your identity will be kept completely confidential.

Sincerely,

Laura Schoenborn

Western Michigan University
616-890-0068
Laura.S.Schoenborn@wmich.edu
Appendix B

Interview Protocol
Appendix B

Interview Protocol

Interview Script for students who graduated from the Manufacturing and Engineering Partnership Program (MEPP):

Date:

Place:

Interviewer:

Interviewee:

Year of Graduation from Program:

Thank you for meeting with me today and consenting to participate in this study. I would like to record this interview so that I can be as accurate as possible for the study. At any point during the interview, you may ask that I turn the tape recorder off.

Interview questions (audio recording begins):

As you may recall, you completed the MEPP program in the last three years. The MEPP program was created to help expose students to careers in manufacturing. I will be asking you a series of questions pertaining to your experiences in the MEPP program.

These questions are all about your perspective as a MEPP graduate:

1. First and foremost, what led you to be a part of the MEPP program?

2. Do you recall what career choices were you evaluating when entering the program?
   a. How, if at all did the MEPP partnership influence your career choice decision?
3. Tell me about your perception of manufacturing upon entering the MEPP program?
   a. Did the MEPP program change that perception of manufacturing and if so, how?
   b. Do you have any specific stories of activities that changed your perception?

4. When thinking about your experiences, what aspects of the MEPP program do you feel help students become interested in manufacturing careers?

5. Do you remember any specific activities in the program that made you interested in manufacturing careers?
   a. If yes, what were those activities and what about them resonated with you?
   b. If no, did activities in the program make you interested in other careers?
      i. If yes, what activities made you interested in other career choices?
      ii. If no, did any aspect of the MEPP program help guide your career interests?
         1. If yes, please explain what aspects helped you to determine your career path?

6. How did your participation in the MEPP program influence your perception on careers in manufacturing?
   a. Where was the program most effective in influencing that perception?
   b. Where was the program least effective in influencing that perception?

7. Do you feel programs like MEPP are filling the gap in getting students interested in manufacturing? Please explain why you feel the way you do.

8. What career did you pursue after graduating from the MEPP program?
   a. Did the MEPP partnership influence that decision?
Thank you for participating in this interview. May I contact you for follow-up interviews or to clarify some of your responses?
Appendix C

Consent Form
Western Michigan University
Department of Educational Leadership, Workforce Education and Development

Principal Investigator: Dr. Adam Manley
Student Investigator: Laura Schoenborn
Title of Study: The Manufacturing and Engineering Partnership Program: An examination of a partnership between manufacturing and CTE

You are invited to participate in this research project titled "The Manufacturing and Engineering Partnership Program: An examination of a partnership between manufacturing and CTE."

STUDY SUMMARY: This consent form is part of an informed consent process for a research study and it will provide information that will help you decide whether you want to take part in this study. Participation in this study is completely voluntary. The purpose of the research is to: understand how a manufacturing and educational partnership impacts a student’s interest in a manufacturing career and will serve as Laura Schoenborn’s dissertation project for the requirements of the PhD in Educational Leadership.” If you take part in the research, you will be asked to participation in an interview. Your time in the study will take approximately 60 minutes and no more than 90 minutes. Possible risk and costs to you for taking part in the study may be taking the time to participate in the interview or answer questions you are not comfortable in answering and potential benefits of taking part may be to bring a better understanding of the impact of a manufacturing and education partnership. An alternative to taking part in the research study would be to answer the interview questions in written format. Your alternative to taking part in the research study is not to take part in it.

The following information in this consent form will provide more detail about the research study. Please ask any questions if you need more clarification and to assist you in deciding if you wish to participate in the research study. You are not giving up any of your legal rights by agreeing to take part in this research or by signing this consent form. After all of your questions have been answered and the consent document reviewed, if you decide to participate in this study, you will be asked to sign this consent form.

What are we trying to find out in this study?

The purpose of this case study is to examine how career experiences students gain through the Manufacturing and Engineering Partnership Program (MEPP) shape their views on manufacturing careers.
Who can participate in this study?

To participate in this study, you would need to be a graduate of the MEPP program.

Where will this study take place?

Interviews will be conducted in a mutually agreed upon location either via telephone, internet or face-to-face.

What is the time commitment for participating in this study?

You will participate in one 60-90-minute interview which includes any follow up questions or clarification that would be required.

What will you be asked to do if you choose to participate in this study?

You will be asked to discuss your experiences in the MEPP program, how the partnership influence your thoughts on manufacturing careers as well as thought on improving that influence. You will also be asked to review a summary of the interview to check for the researcher’s accuracy.

What information is being measured during the study?

The information being measured is the influence the program had on students who graduated from the MEPP program.

What are the risks of participating in this study and how will these risks be minimized?

There is very little risk in participating in this interview. There is a small possibility that answer some of the questions could bring discomfort. To minimize this risk, you will not be required to answer any questions that cause you discomfort and you can stop the interview at anytime.

What are the benefits of participating in this study?

A benefit to participating in this study is that you are able to discuss the influences the MEPP program had on you which could lead to future research that would help to improve and expand the experiences gained from the MEPP program.

Are there any costs associated with participating in this study?

There will be no costs incurred when participating in this study unless the agreed upon location requires a parking or transportation fee.

Is there any compensation for participating in this study?

There is no compensation for participating in this study.

Who will have access to the information collected during this study?

All information collected from this study will be kept completely confidential. Your identity would only be known to me as the student investigator. To ensure accuracy, the interview will be recorded using an
audio recording devise and downloaded onto a computer for transcription, storage, and protection. Your name will not appear on any documents on which information is recorded. You will also be able to choose a pseudonym which will be used for coding purposes. The student researcher will keep a separate master list with names of the participants and corresponding pseudonym. Once the data is collected and analyzed, the master will be destroyed. Your identity will not appear in any presentation or publication of the results of the study.

**What will happen to my information or biospecimens collected for this research project after the study is over?**

After information that could identify you has been removed, de-identified information collected for this research may be used by or distributed to investigators for other research without obtaining additional informed consent from you.”

**What if you want to stop participating in this study?**

You can choose to stop participating in the study at any time for any reason. You will not suffer any prejudice or penalty by your decision to stop your participation. You will experience NO consequences either academically or personally if you choose to withdraw from this study.

The investigator can also decide to stop your participation in the study without your consent.

Should you have any questions prior to or during the study, you can contact the principal investigator, Dr. Adam Manley at 269-387-3721 or Adam.Manley@wmich.edu or the student investigator, Laura Schoenborn at 616-890-0068 or Laura.S.Schoenborn@wmich.edu. You may also contact the Chair, Institutional Review Board at 269-387-8293 or the Vice President for Research at 269-387-8298 if questions arise during the course of the study.

This study was approved by the Western Michigan University Institutional Review Board (WMU IRB) on (approval date).

Participating in this survey online indicates your consent for use of the answers you supply.
Appendix D

HSIRB Approval
Date: April 5, 2021

To: Adam Manley, Principal Investigator
    Laura Schoenbom, Student Investigator for dissertation

From: Amy Naugle, Ph.D., Chair

Re: IRB Project Number 21-03-30

This letter will serve as confirmation that your research project titled “The Manufacturing and Engineering Partnership Program: An Examination of a Partnership Between Manufacturing and CTE” has been approved under the expedited category of review by the Western Michigan University Institutional Review Board (IRB). The conditions and duration of this approval are specified in the policies of Western Michigan University. You may now begin to implement the research as described in the application.

Please note: This research may only be conducted exactly in the form it was approved. You must seek specific board approval for any changes to this project (e.g., add an investigator, increase number of subjects beyond the number stated in your application, etc.). Failure to obtain approval for changes will result in a protocol deviation.

In addition, if there are any unanticipated adverse reactions or unanticipated events associated with the conduct of this research, you should immediately suspend the project and contact the Chair of the IRB for consultation.

The Board wishes you success in the pursuit of your research goals.

A status report is required on or prior to (no more than 30 days) April 4, 2022 and each year thereafter until closing of the study.

When this study closes, submit the required Final Report found at https://wmich.edu/research/forms.

Note: All research data must be kept in a secure location on the WMU campus for at least three (3) years after the study closes.