Factors Impacting the Career and Technical Education Teacher Pipeline in Midwest States

by

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Feuerhelm, Kathryn M. ***Factors Impacting the Career and Technical Education Pipeline in Midwest States***

Abstract

There is a gap in the supply and demand for career and technical educators. This results in reduced opportunities for participation in CTE courses. Examining CTE teacher supply and demand across the nation is a challenge because of this lack of comprehensive data. The purpose of this qualitative study was to examine the systems and structures that exist for data collection related to CTE teacher education in Midwest states, as well as considering the ways in which data sources and systems are used to address the issue of teacher supply and demand. In this qualitative study, the researcher interviewed individuals related to CTE in Illinois and Wisconsin to investigate the data systems and structures they interact with to recruit students to teacher preparation programs, retain teacher candidates in preparation programs and follow individuals throughout their career. This study found that there are formal and informal data systems in place which impact the CTE teacher pipeline, and components of these systems are effective in informing CTE teacher supply and demand. Barriers to accessing or using data also exist within the systems, preventing individuals from using them to inform teacher supply and demand. There are stages in a teacher's career where targeted interventions or supports could retain teachers in the pipeline, but without available comprehensive supply and demand data there is reduced capacity to do this. This study calls for further research to identify organizations who have the capacity to collect and compile data that individuals in this study indicated they desired.

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Chapter I: Teacher Supply and Demand in ACTE Region III

Around the world, teachers are a critical component of educational systems. Globally, teacher shortages are creating challenges in education (Ashiedu & Scott-Ladd, 2012). A teacher shortage is defined as a gap between the demand for qualified teachers and the number of qualified teachers available for hire each year (García & Weiss, 2019a). More pronounced in the public sector, the shortage of qualified educators threatens educational outcomes around the globe. Worldwide, the number of educators required by 2030 to ensure an equitable educational experience for all is projected to be as high as 68.8 million, according to the United Nations Educational, Scientific and Cultural Organization Institute for Statistics (UNESCO, 2016). In 2003, the Organisation for Co-Operation and Development (OECD, 2003) predicted a teacher shortage and cited the growing student population, increasing age of the educational workforce and insufficient numbers of new teacher entering the profession as the culprits.

The teacher shortage in America is also a looming crisis (McHenry-Sorber & Campbell, 2019). American public education relies on qualified and well-trained teachers to manage pre-kindergarten through 12th grade learners. Staff play a large role in the overall functioning of the education system, and shortages result in crowded classrooms, discontinued programming, increasing staff workloads, and ultimately reduced outcomes for learners (Darling-Hammond et al., 2016).

The School Administrators of New York State (2020) suggest that reduced numbers of available trained and licensed teachers result in the hiring of less-qualified educators and increased teacher turnover. Because of shortages, courses may be covered by paraprofessionals or substitutes, and in some instances class sizes are increased to make up for the lack of a qualified teacher in the classroom. Research shows decreased performance in students at schools

with higher teacher turnover (School Administrators Association of New York State, 2020). Staff instability and turnover create turmoil in districts because recruiting and hiring tie up financial resources and demand a great deal of time and effort, deteriorate the cohesion of the school, and decrease student achievement (García & Weiss, 2019a).

The topic of the teacher pipeline has been discussed for decades in various situations and circumstances (Pennington McVey & Trinidad, 2019), and there has been continued research on the topic over the past thirty years (Zirkle & Winegardner, 2005). Across the nation, a shortage of qualified educators threatens student opportunity and educational programming for states. "The teacher shortage is real, large and growing, and worse than we thought" (García & Weiss, 2019a, p. 1). Following the Great Recession, districts moved from laying off teachers and cutting programs to reinstating courses and refilling teaching roles. What they learned, according to Carver-Thomas and Darling-Hammond (2017) was that the pool of educators from which to draw was insufficient to meet the demand. To rebuild programs and achieve pre-recession student-teacher ratios would require hiring 145,000 educators, in addition to standard staffing demands.

This gap in qualified, available educators is a multifaceted issue with a handful of factors contributing to the shortage. In 1975, 22% of students pursuing a college degree in America chose education as a major (Zarra, 2019). By 2015, that number had dropped to 11%, with a drop in female interest in the profession most notable. Over the past four decades, the percentage of female college students pursuing education as a major has fallen from 32% to 11% (Zarra, 2019). What was once a predominantly female profession has become less attractive to women, contributing to the gap in available educators to fill the need in America's schools.

In addition to a reduced number of candidates entering the profession, attrition can be attributed to poor working conditions, low pay, lack of support and opportunities for professional development, and increasing pressure to meet the requirements of standardized testing (Boyce, 2019). Of teachers who leave the profession, only one third are likely to return (Carver-Thomas et al., 2017). Between retirees and teachers who have walked away from the profession there is a pool of available educators, but the system has failed to entice many to return to public education. Researchers compare the current teaching snapshot to a 'leaky bucket' (Carver-Thomas et al., 2017, p. 1), a system that is losing teachers as quickly as newcomers can be recruited.

While typically discussed as a national issue, the demand for teachers is also a relevant conversation at regional and local levels. Certain demographic conditions often result in greater staffing challenges for specific areas and populations. For example, Miller et al. (2019) reported that rural schools and economically disadvantaged areas tend to prove more difficult to recruit and retain high-quality teachers than their suburban counterparts. Districts located in rural areas have a disadvantage hiring and retaining teachers because of the isolating nature of remote areas. Small districts may not have the resources or capabilities to offer mentorship or professional development opportunities like larger urban school districts (Monk, 2005). In addition, urban districts often pay substantially better wages, resulting in teachers leaving rural schools for larger districts (Hammer et al., 2005). Along with higher pay, increased number of students with special needs, students with limited English language capabilities and fewer college-bound students are student characteristics that increase the difficulty in recruiting and retaining high-quality educators in small rural schools (Monk, 2005).

Demographic factors also result in inequitable conditions, a concern in an American educational system which demands equality. When there are not enough teachers to fill positions, districts with limited resources suffer the most. These districts are typically high-poverty and serve economically disadvantaged learners (García & Weiss, 2019b). In fact, teacher turnover rates are "70% higher for teachers in schools serving the largest concentrations of students of color" (Carver-Thomas & Darling-Hammond, 2017, p. 1). Schools which serve a greater number of low-income students, labeled Title I schools, experience greater turnover rates than their higher-income counterparts (Carver-Thomas & Darling-Hammond, 2017).

Beyond the general demand for educators, specific disciplines prove especially difficult to fill positions. Career and Technical Education (CTE) programs are an area of great concern when it comes to filling teaching positions (Devier, 2019). Formerly referred to as vocational education or vocational education and training (VET) outside of the U.S., American CTE programs have been recognized for at least 100 years (Fletcher et al., 2015). Modern day CTE programs include agriculture, business, marketing, family and consumer sciences, health science occupations, technology education, and trades and industry education programs (Strengthening Career and Technical Education for the 21st Century Act, 2018). Within each of these disciplines, curriculum focuses on applied academic learning and career preparation. An important factor in CTE is to maintain high-quality, trained staff. Hyslop and Imperatore cite "prepared and effective program staff" (2018, p. 2) as a component of high-quality CTE programs. Teachers in CTE must have technical workforce knowledge in combination with educational pedagogy. In addition, each discipline is vast in its own content, requiring a broad base of subject-matter understanding.

Career and Technical Education is included in national federal education legislation which demands that students graduate college and career ready. The “Strengthening Career and Technical Education for the 21st Century Act,” commonly referred to as the Perkins Act, was reauthorized in 2018 with strong bipartisan support (Lunchner, 2018). Despite the importance placed on college and career readiness, many CTE programs are considered elective credits and are not required for graduation. Because of this, when teachers are unavailable for hire, districts have the option to reduce or remove the program altogether. Quinton (2017) quotes Stephen Jones, the superintendent of schools in Little Falls, Minnesota when explaining this phenomenon. Jones states that his district hasn’t had to cancel any courses for lack of instructors, but he says smaller districts in the state have. This unfortunate trend results in “high schools cutting career and technical education courses because they can’t find qualified teachers (Quinton, 2017, para 1).” This loss results in reduced programming and opportunities for students to gain academic knowledge and explore career pathways. Referencing the declining availability of CTE programs, cites the direct impact that this loss will have on the workforce and availability of trained employees. Some states have been reporting shortages in CTE areas for two decades, according to Quinton (2017).

Beginning in elementary school, CTE curriculum includes pathways from education to the workforce, preparing students for a specific cluster of work by offering technical, academic and employability skills. According to the Association for Career and Technical Education (2020), 94% of secondary students participate in CTE opportunities. CTE is one of many components that make up the American education system, a structure that is feeling intense pressure to increase academic achievement (Blowe & Price, 2012). CTE coursework provides the knowledge, skills and dispositions that serve as a foundation for future training and

employability. A study conducted by Castellano et al. (2017) found that increasing CTE credits results in higher graduation rates. Their research has suggested that there are benefits for students who participate in CTE experiences.

Statement of the Problem

The United States is currently experiencing a shortage of educators (García & Weiss, 2019a). The shortage is defined as the gap between qualified educators available for hire and the number of open positions. Though the teacher shortage has been examined for decades, there is still a significant gap in the supply and demand for career and technical educators and little explanation for the phenomenon (Pennington-McVey & Trinidad, 2019). Examining this demand is challenging because of a lack of a comprehensive analysis of the teacher labor market (Sutcher et al., 2019), among other factors.

Despite legislation demanding preparedness in college and career readiness and increasing interest in CTE courses (Milgram, 2017), learners across the United States who could benefit from CTE opportunities may be lacking access due to unfilled teaching positions. Without available credentialed teachers, some districts find themselves turning away interested students because of their lack of ability to offer programs (Chen & Ney, 2020). The deficiency of educators, specifically in CTE areas, results in reduced opportunities for participation in CTE courses.

Specifically, in Region III, defined by the Association for Career and Technical Education (ACTE) as Iowa, Illinois, Indiana, Missouri, Minnesota, and Wisconsin, a supply and demand issue of CTE teachers has been identified. In 2016, discussions on the teacher shortage were initiated by ACTE Region III. These conversations began at the regional level, but it became immediately apparent that the demand for CTE teachers was a nationwide concern

(*ACTE Opportunity Fund Region III CTE Teacher Shortage Project*, 2019). Using monies from the ACTE Opportunity Fund, research was conducted to gather more information on the issue. Having two goals, research and data collection, this project ultimately uncovered the lack of existing data on the CTE teacher shortage. That research indicated reduced numbers of teachers entering traditional CTE teacher preparation programs, dropping from 895 in 2010-2011 to 565 in 2015-2016 (ACTE Opportunity Fund Region III CTE Teacher Shortage Project, 2019). A recommendation from the Executive Summary was to continue the data collection efforts.

Statement of the Purpose

The purpose of this study is to examine the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III, as well as examining the ways in which data sources and systems are used to address the issue of teacher supply and demand. Within these states, there are varying systems to collect data on teacher recruitment and retention within teacher preparation programs and state departments of education (ACTE Opportunity Fund Teacher Shortage Project, 2019). Though these systems exist, they are not consistent across the region and do not offer data that allows for regional comparison or decision-making. Components of the teacher pipeline have been examined in recent research and some promising strategies to address recruitment and retention have been identified. However, the lack of available, accessible data negatively impacts the ability to implement strategies to recruit and retain CTE teachers. With accurate data across Region III, steps could be taken to replicate promising practices on a larger scale and make an impact on the issue of supply and demand in CTE education.

Research Questions

The research questions guiding this study included:

- What structures and systems exist to gather data on teacher supply and demand in the states within Region III, specifically Illinois and Wisconsin?
- How are the systems and data being used to address teacher supply and demand in Region III, specifically Illinois and Wisconsin?
- What characteristics of these systems are successful in informing strategies to recruit teacher candidates through programs completion and retention in the field?

Assumptions

The following are assumptions that the researcher believed to be true in ACTE Region III states at the time of the study:

- There are formal systems in place to collect data on the teacher pipeline.
- There are informal systems in place to collect data on the teacher pipeline.
- Departments of Education and teacher education programs within universities are willing or able to share information on teacher supply and demand.

Significance of the Study

This study is significant for two reasons: teacher recruitment and teacher retention. The first area of significance for this research is to better understand teacher candidate recruitment to traditional teacher-preparation programs in the Midwest. Understanding how educators are recruited into teacher preparation programs will allow for informed decisions to be made regarding recruitment practices. CTE Program Directors and college recruitment departments could use data on the demographics of who is and who is not enrolling in teacher preparation programs. Promising practices could be examined and shared in an effort to better recruit individuals into CTE teacher preparation programs. With available data, trends can be examined and used to replicate best practices and successful strategies.

The second area of significance of this study is for teacher retention. Teacher turnover has damaging effects to student achievement, is detrimental to school culture and expensive for districts (Teacher Effectiveness, 2018). Many teachers are leaving education prior to retirement, and few choose to return to the profession. There are programs and systems that have shown success in retaining teachers, but more data is needed before they can be successfully implemented. School administrators who are struggling to fill open positions within their districts would benefit from having accurate data on the teacher pipeline. Promising practices could be implemented with appropriate data on potential teacher candidates. By finding this information in Region III, this study could be replicated on a larger scale and inform districts across the nation.

In addition to providing data for teacher recruitment and retention, this study offers recommendations for further research and examination of the ongoing issue of teacher supply and demand. To fill the teacher pipeline, CTE areas need accurate data to inform their program decisions.

Limitations of the Study

The Association for Career and Technical Education (ACTE) defines Region III as the states of Iowa, Illinois, Indiana, Minnesota, Missouri, and Wisconsin. These states are all located in the Midwest and have been grouped geographically. Because of this grouping the data that was collected in this research may not be representative of the United States as a whole, and the results may not be generalizable to a larger population.

Educator preparation programs vary in scope and size. When comparing programs, the unique characteristics across programs did not allow for clear alignment of measurable components. Fletcher et al. (2015) attest that the current teacher preparation structure “has

resulted in an array of programs with different identities and a field that appears to lack an agreed upon body of knowledge or curriculum" (p. 192). Even within traditional teacher preparation programs, CTE programs are often housed in different locations within colleges. Some are housed within a school of education while others exist within other areas of the university such as the College of Business, Agriculture, or Professional Studies. This variation of structures and systems posed limitations on the ability of the researcher to collect consistent data.

In addition, limitations may have been influenced by teacher licensing requirements. The requirement that states demand for teachers vary broadly throughout the Midwest and across the nation. In fact, no two states have the same licensing requirements (Devier, 2019). The differences in licensing requirements were a limitation in comparing recruitment and retention strategies across states. In many states, the high demand for educators has led to alternative training and licensing programs being used to fill the teacher pipeline. These pathways to alternative licensing are in a constant state of change based on a variety of influences (Devier, 2019), creating further challenges for clear comparison of teacher licensing.

Definition of Terms

The following terms are used in this research in relationship to the CTE teacher pipeline.

Alternative Teacher Preparation Program(s)

Alternative Teacher Preparation Programs refers to teacher preparation programs that fall outside of the traditional structure of teacher preparation. Zirkle, Martin, and McCaslin (2007) cite over 100 variations of training that exist in alternative teacher preparation in the United States.

Midwest

For the purpose of this research, the Midwest will be defined as Illinois, Indiana, Iowa, Minnesota, Missouri, and Wisconsin.

Teacher Attrition

Teachers who leave the profession entirely. For this study, teacher attrition refers to educators who have left the profession before retirement.

Teacher Migration

Teacher migration is when teachers transfer to jobs in a different district. This refers to teachers who stay in the profession but change districts.

Teacher Preparation Program (Educator Preparation Program)

A teacher preparation program is where a potential educator builds a foundation on knowledge that will prepare them for the profession (Feuer, et al., 2013).

Teacher Shortage

A teacher shortage is defined as a gap between the demand for qualified teachers in the schools and the number of qualified teachers available for hire each year (García & Weiss, 2019a)

Traditional CTE Teacher Preparation Program

Traditional Teacher Education Preparation Programs are state-approved programs of study that encompass pedagogy, technical training, student teaching and culminates in a bachelor's or master's degree (Zirkle et al., 2007). This training may vary from state to state and from one university to another but largely follows a similar format. Traditional teacher preparation programs in CTE typically consist of technical and pedagogical training and culminate with a supervised student-teaching experience.

Chapter II: Review of the Literature

Internationally, in the United States, and specifically in ACTE Region III, there is a high demand for educators. Teacher staffing challenges across the globe are affecting the educational field (Ashiedu & Scott-Ladd, 2012). A shortage of teachers is not a new topic, but one that has become a recent discussion point in educational circles (Sutcher et al., 2019). Although there are shortages in many content areas (Zarra, 2019), career and technical education (CTE) is an area that has been experiencing a high demand for qualified educators for several years, documented in every U.S. state (Devier, 2019).

When CTE teachers are not available to fill open positions, the opportunity for students to participate in programs is reduced. Research shows that CTE programs are beneficial for learners (ACTE, 2020), and a lack of offerings results in missed exposure to college and career readiness programs. There are promising programs and strategies that could be implemented both at the state and regional level, but more data is needed on existing CTE programs. In order to better understand the regional snapshot of CTE teacher recruitment and retention, data was attained from ACTE Region III, which consists of Illinois, Indiana, Iowa, Minnesota, Missouri and Wisconsin.

The purpose of this study was to examine the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III, as well as examining the ways in which data was used to address CTE teacher supply and demand. The research questions guiding the study were:

- What structures and systems exist to gather data on teacher supply and demand in the states within Region III, specifically in Illinois and Wisconsin?

- How are the systems and data being used to address teacher supply and demand in Region III, specifically in Illinois and Wisconsin?
- What characteristics of these systems are successful in informing strategies to recruit teacher candidates through program completion and retention in the field?

The literature was divided into four sections to outline the need for this research on the systems and structures in place in ACTE region III related to the supply and demand of CTE teachers. The first section outlines the existing gaps in data in relationship to systems that track teacher recruitment and retention. The second section outlines teacher recruitment, specifically examining factors affecting recruitment and strategies that have been attempted in relationship to recruitment. The third section discusses teacher retention, again examining factors and strategies as they relate to the topic. In addition to examining the need for this research through systems and structures, the final section introduces the Teacher Career Cycle Model as a framework by which to examine educator recruitment and retention as they relate to the teacher pipeline.

Gap in Teacher Supply and Demand Data

A shortage of teachers in CTE is problematic, and the difficulty of finding qualified educators challenges districts across the nation. CTE is one of the mainstays of the American education system (Nwoke & Wilkin, 2011), and participating in programs is beneficial for students. The Association for Career and Technical Education (ACTE, 2020) states that 94% of high school students participate in CTE, learning necessary workplace skills to attain “high wage, high skill, and high demand” professions (ACTE, 2020). However, as interest in CTE grows (Milgram, 2017), filling classrooms with high-quality, trained educators is proving to be difficult.

Though currently a top national conversation and talking point in schools across the region, staffing challenges are not new to education. Sutcher et al. (2019) references patterns of need in American schools dating back to the 1930's. Despite being an age-old issue, teacher shortages across disciplines have been increasing over the past decade (Sutcher et al., 2019). As administrators and state departments struggle to fill teaching positions, the issue has bubbled to the surface, demanding attention. The lack of teachers in classrooms is detrimental to students, teachers, and the education system as a whole (García & Weiss, 2019a).

The lack of existing data is a barrier to accurately comparing teacher supply and demand across the nation, and specifically in CTE. In 2016, conversations surrounding the topic of teacher supply and demand at the national and regional levels initiated a regional research project. Using ACTE Opportunity Funds dedicated to the project, ACTE Region III was the focus area for research on the topic (ACTE Opportunity Fund Region III CTE Teacher Shortage Project, 2019). The project had two components, research and data collection. The research portion of the project intended to examine literature on best practices for managing the apparent supply and demand issue in CTE. The research portion of the ACTE Opportunity Fund project discovered that there was a gap in the data available on CTE supply and demand in the region. Because the state departments in Region III were understaffed, the study had to rely on data that was available on public websites. The study found that teacher preparation programs existed in Region III, though some included were not currently operating (see Table 1). In addition, states were using alternative pathways to quickly fill the pipeline. Across the region, these pathways all intended to fill the teacher pipeline, though they were varied in scope and requirements.

Table 1

CTE Teacher Preparation Programs in ACTE Region III

State	Number of programs
Illinois	20
Indiana	21
Iowa	18
Minnesota	9
Missouri	19
Wisconsin	16

Note. From *ACTE Opportunity Fund Region III CTE Teacher Shortage Project*, by Association for Career and Technical Education, 2019, (https://www.uwstout.edu/about-us/news-center/acte-opportunity-fund-region-iii-cte-teacher-shortage-project). Copyright 2019 by ACTE.

Perda (2013) cites a lack of existing data as a barrier to examining teacher turnover, citing a gap in systems that track teachers who leave the state that they are employed in or move between districts. This lack of comprehensive data also results in an inefficient way to tell if the supply of teachers is too high or too low at any given period of time (Perda, 2013). As a result, this may prevent effective strategies and promising practices from being implemented because there is not information available on where the efforts would be best applied.

Research on the topic of teacher turnover is challenged by gaps in existing data. The U.S. Department of Education hosts a database that allows for generating reports on teacher shortage areas (United States Department of Education, n.d.). The data made available is intended to assist educators seeking open positions and inform federal financial aid repayments or disbursements. This data does allow for some state-to-state comparisons, though not comparison related to teacher recruitment or retention. Without sample sizes large enough to generalize, it is difficult or impossible to study teachers at various points in their career (Perda, 2013).

Statewide research has been conducted in an attempt to examine staffing difficulties in education. California is listed by York (2020) as the state with the most critical teacher shortage, with 80% of districts were struggling to fill classrooms with teachers. Becker (2017) called the demand for qualified teachers in California a crisis, with schools increasing pay, offering moving stipends and implementing sign-on bonuses as recruitment tools. Darling-Hammond et al., (2016) point to a 70% decline in enrollment in teacher preparation programs as a sign of concern in the California educational system. To meet the demand, the state has implemented waivers and permits to allow individuals to become teachers quickly and without traditional training, and these teachers are employed disproportionately at high-minority and high-poverty schools.

From the job search engine EdJoin, Darling-Hammond et al., (2016) were able to examine the issue and determine that the teacher supply was not keeping pace with the level of demand. While their research has identified issues in the educational system and offered recommendations for improvement, it also pointed out the need for data and demographics in order to implement effective recruitment and retention strategies.

Data Collection Systems

The National Governors' Association has stressed the importance of data and accurate information on educational systems and the workforce. Making a case for the bridge between education and employment, the association recommended the development of statewide data systems to collect comprehensive labor market information (National Governor's Association, 2021). The intent of this effort was to curate an environment of lifelong learning through the use of accurate, real-time data. Despite being a promising recommendation, the effort has only been piloted in a handful of states.

The Florida Education and Training Placement Information Program (FETPIP) is a statewide data collection and reporting system that uses longitudinal student data obtained from sources representing educational institutions, employment, corrections and public assistance (National Governors Association, 2021). Operational for nearly 30 years, the database offers information on over 20 million former students and provides information on the bridge from education to the workforce. Unfortunately, this system has limitations that prevent it from accurately tracking the real-time teacher pipeline, and it has not been replicated broadly throughout the United States.

Universities across the nation have a variety of ways to track data on teacher candidates and graduates. The National Center for Education Statistics (NCES), located in the U.S. Department of Education, conducts the Integrated Postsecondary Education Data System (IPEDS) annually. This system of surveys gathers program-level data from every university that is tied to federal student financial aid funding programs (U.S. Department of Education, n.d.). IPEDS collects data on institutional characteristics, prices, admissions, enrollment, financial aid, degrees offered, student success, institutional libraries, and human resources. Information gathered includes enrollment and retention rates and completion rates by field. Although this data is used heavily by some sectors, such as the military, there are recommendations for improvement of the instrument to include graduate and transfer students. IPEDS offers higher-level program data rather than student level data (Miller, 2019), and does not offer a comprehensive snapshot of the teacher pipeline.

The National Student Clearinghouse (2020) collects some student-level data for enrolled students K-20. The Clearinghouse employs a variety of techniques to track students in public and private institutions. However, student recruitment efforts and post-graduation activities are not

included in the statistics. For this reason, recruitment and retention of teachers cannot be accurately measured or tracked using this resource alone.

TeachAg is a system that has been identified as a response to the issue of teacher supply and demand. Dating back to 1999, the TeachAg website offers annual national supply and demand data. This data is collected annually by members of the American Association for Agricultural Education (AAAE). Faculty from Pennsylvania State University, Utah State University; and University of Minnesota collected, studied and compiled data in an executive summary in cooperation with the National Teach Ag Campaign and the National FFA Organization (National Association of Agricultural Educators, 2020). Data collected is shared in a regional profile overview and includes information on programs, teachers, salary, contract days, enrollment in educator preparation programs, preparation program graduates and unfilled positions. These profiles allow for annual comparison and recommendations for programming in the discipline. Unfortunately, this data does not exist across all CTE program areas.

Gaps in Teacher Licensing Data

State departments across the country use differing methods to license teachers and track teacher credentials and employment. The Education Commission of the States (2020) lists eight states who offer full reciprocity of teacher licensing. Reciprocity of teacher licenses is when candidates who hold an out-of-state license meet specific requirements in order to obtain a license in another state (Education Commission of the States, 2020). Thirty-seven states differentiate requirements for licensing between new and experienced educators, allowing experienced teachers reduced barriers to teach in the state, though the requirements for licensing vary. In addition to these inconsistencies across states, many have loosened or removed barriers to teaching in an attempt to increase the available pool of teacher candidates. Aragon (2016)

outlined recommendations from task force groups on the topic across seven states, with many calling for flexibility in licensing. For example, Oklahoma's task force recommended policy change that allows for certain work experience to take the place of GPA requirements (Aragon, 2016). In Wisconsin, an Experience-based Technical and Vocational Education Subjects license can be obtained through previous work experience and is valid in any district (Wisconsin Department of Public Instruction, 2018).

Some states have introduced creative licensing strategies to fill empty positions, catering to local and regional needs to fill the void. Citing a lack of recent research, Devier (2019) draws parallels between the constantly changing and inconsistent pathways to licensure and the lack of filled CTE positions. "The 50 states and the District of Columbia reported 122 alternative routes to teacher certification pathways in 2017 (Devier, 2019, p. 49). Examining the teacher shortage in the United States through the lens of licensing offers insight into the barriers of entering the profession or obtaining appropriate licensing to obtain move state-to-state.

Zirkle et al. (2007) point to alternative training as one issue in the teacher shortage. Although the practices allow teachers to quickly meet requirements to enter the classrooms as educators, the outcomes are not always positive solutions. Through alternative pathways, Zirkle et al. attest that teachers are being poorly trained and leaving the profession as a result. In this situation, filling the pipeline with alternatively trained teachers is often only a short-term patch rather than a true solution. Despite this creativity and loosening of licensing restrictions across states, research demonstrates that these efforts to fill the pipeline are inadequate. Unlike traditional teacher education programs which are relatively similar in design, alternative licensing is implemented differently across the United States. It is a complex, multifaceted issue, and the research calls for further examination of teacher licensing and alternative pathways.

CTE Teacher Recruitment

In examining the CTE teacher shortage, both recruitment and retention must be considered to address teacher supply and demand. A variety of factors impact teacher recruitment and retention, and it is important to examine the challenges that districts face in attracting and retaining effective educators. The declining supply of potential teacher candidates entering preparation programs is one reason for a supply issue, making recruitment an important factor to consider.

Factors Affecting CTE Teacher Recruitment

A challenge to filling the pool of qualified educators is to get candidates interested in the profession and enrolled in teacher preparation programs. Research shows that overall enrollment in teacher preparation programs is declining across all teacher preparation program types, indicating that fewer individuals are choosing to enter the field of education (U.S. Office of Postsecondary Education, 2015). Enrollment in total teacher preparation programs dropped from 719,081 in the 2008-2009 school year to 499,800 in 2012-2013 (U.S. Office of Postsecondary Education, 2015). Enrollment has decreased not only in traditional teacher preparation programs, but in alternative programs (U.S. Office of Postsecondary Education, 2015). In the same study, alternative program enrollment fell by approximately 190,000 teacher candidates between 2008-2009 and 2012-2013.

The Education Commission of the States offered data demonstrating a drop in both high school student interest in education as a career and enrollment in teacher preparation programs (Aragon, 2016). Fewer high school students indicated that they were interested in teaching as a career, and the statistics indicate that some states have seen declines in program enrollment as high as 50% between 2010 and 2018 (Nietzel, 2019). Darling-Hammond et al. (2016) predicted

that this trend would continue as students choose to explore other career options as a result of higher standards for entry on the college admissions test that many states have put in place. In addition to lower enrollment, completion rates in teacher preparation programs have decreased by almost 30% nationwide (Partelow, 2019). Every state has experienced a decline, with some declining by more than 50%. With fewer students entering and completing programs, a supply of teachers is limited. With reduced numbers of teachers coming out of traditional preparation programs, attracting qualified staff is a challenge (Zarra, 2019).

Reasons that students choose fields other than education vary greatly, but research points to a few main areas of influence. Nietzel (2019) named inadequate teacher salaries and undesirable working conditions as reasons for the decrease. Another reason that students may not choose to pursue education as a career is a lack of knowledge about the career pathway. Increased opportunities for women and females in science, technology, engineering and math (STEM) careers also appear to be affecting the influx of teachers entering the pipeline (Zarra, 2019). Specifically, in CTE disciplines, avenues to pursue the profession or locate appropriate training to enter the field varies greatly (Keily & Perez, 2020). Finally, students may steer clear of the profession because of reduced parental influence to pursue the career (Schaffhauser, 2019). When asked if they would recommend teaching as a career to their own children, over half of the parents in one study replied that they would not (Will, 2018). This is a steep decline from 2009, when 70% of parents in the same survey responded that they would support their child pursuing a career in education (Phi Delta Kappa International, 2018).

Adding to the challenges of recruiting teachers, recruitment can be difficult in rural areas (Hasselquist & Graves, 2020). Some reasons rural areas struggle to recruit teachers are their remote locations and lack of funds to offer competitive pay. Research indicates that rural areas

are often staffed with teachers who are paid 21% less than the national average for their urban counterparts, with approximately 20% holding a second job to make ends meet (Monk, 2005). Because of this, schools in rural areas experience high teacher turnover rates and often struggle to fill open positions (Monk, 2005). Another concern is the lack of diversity these areas offer. Alvero (2019) tells the story of a South Sudanese refugee who turned down a job in a rural Colorado district because it was a community where the educator would stand out because of her ethnicity.

The nature of small rural schools may restrict a teacher's ability to specialize in one area of their chosen field. In career and technical education, a Technology and Engineering Education teacher may teach all the classes from sixth through twelfth grade. This variety of classes could range from woodworking and welding to building construction and small engines. Unlike a larger school where increased student enrollment allows for teachers to stay in a smaller segment of their discipline, many rural teachers find themselves the sole educator in a broad field and work with a wider age range than their urban peers (Monk, 2005). Each of these reasons may be contributing to a decline in interest in education as a profession and a subsequent drop-in teacher preparation program enrollment.

This steep decline in interest in teacher preparation programs has forced colleges to make difficult program decisions. In response to changing student desires and budget cuts, the University of South Florida eliminated their comprehensive College of Education. University President Ponticell stated that the change "reflects the evolving demands of students, who are increasingly seeking alternative pathways to teacher certification outside of the traditional baccalaureate degree" (Flaherty, 2020, para. 5). The author also attests that universities have

responded to the decline by combining programs, keeping programs on the books but not currently running courses, or exploring alternative pathway options.

Strategies to Address CTE Teacher Recruitment

Research on teacher recruitment offers some promising practices. Chen and Ney (2020) offer several strategies to increase CTE teacher recruitment, including building awareness of the profession, improving the reputation of the discipline, and building relationships between secondary schools and educational training programs. They suggest that increasing awareness throughout secondary school buildings about CTE opportunities and promoting the profession as a viable career may spark interest in secondary students. In addition, increasing awareness by specifically targeting individuals who may have work or lived experience and would be able to obtain dual licensure may lure professionals from other careers into teaching (Chen & Ney, 2020). They also suggest that removing the deficit lens that CTE is sometimes viewed through as an important step in recruiting teacher candidates to the profession. Based on old traditions of CTE being ‘less than’ academic programs or a dumping ground for students who are not a good fit in other courses, CTE has a somewhat tarnished reputation that is preventing potential educators from entering the profession. Finally, Chen and Ney (2020) point to the fragmented relationships between high schools and institutions of higher education. Citing unclear or broken articulation agreements and a lack of communication, the authors believe that this communication barrier restricts the ability or desire of students to enter teacher preparation programs. By better advertising and promoting CTE teacher education programs, along with removing barriers to program entry, increased awareness and enrollment may result in more individuals considering teaching within CTE as a viable career pathway.

The National TeachAg Campaign (NTAC), a component of the National Association of Agricultural Educators (NAAE) has initiated a large-scale initiative to recruit and retain Agricultural Educators (National Association of Agricultural Educators, n.d.). Recognizing the need for an increased supply of high-quality educators, NAAE established the campaign to raise awareness of the profession. The campaign collects data on the profession and programs which they use to inform their efforts. Though it began as a recruitment campaign, the movement has grown, expanding to include efforts to retain teachers who are currently employed in the field. Together with their partner organizations, the National FFA Organization and National Council for Agricultural Education, the campaign boasts a wealth of activities and events to promote the profession.

One practice that TeachAg promotes is encouraging individuals to nominate students to be future agriculture educators (National TeachAg Campaign, 2021). Through a nomination form and a packet of 'Tagged to Teach Ag' materials, individuals and educators can identify students who may have interest in the profession or be a good fit in the field. In addition, the organization offers scholarships and workshops and career development events. Recognizing the importance of parental input, the campaign has a dedicated parent portal on their website which includes resources boasting financial information, job market information, and testimonials on the profession (National Teach Ag Campaign, 2021). Beyond this, workshops, symposiums, signing events, an ambassador program and National Teach Ag Day are strategies NTAC uses to fill the teacher pipeline of ag teachers. Although TeachAg has developed an organized effort for recruiting teacher candidates into the pipeline, other CTE areas have not rolled out strategies that are equivalent in scale or success.

CTE Teacher Retention

Teachers that complete programs but leave the profession are another reason that there is a growing demand for high quality educators in CTE classrooms. For that reason, retention is a second factor that demands attention when examining the issue of teacher supply and demand.

Factors Affecting CTE Teacher Retention

When teachers leave their position, it often creates a staffing challenge for districts. It is difficult for administrators to fill the void when the pool of available qualified candidates is small or nonexistent. Recognizing the challenges districts experience in hiring high-quality, qualified staff, retention of teachers is an important measure in keeping schools fully staffed. There are a variety of reasons that educators give for leaving the classroom, either migrating to another district or leaving the profession entirely.

Teacher Migration. One reason for vacancies is teachers who leave for a job in a different district. These ‘movers’ make up about 8% of the teaching force annually (Carver-Thomas & Darling-Hammond, 2017). Though some switch districts because of family or commuting reasons, many leave early-career positions in high-poverty districts for positions in better paying, more affluent districts. In fact, García and Weiss (2019a) report that over one third of high-poverty districts listed the experience of filling a vacancy as “very difficult,” making this teacher migration a challenge to districts. Teacher migration negatively impacts student achievement, staff morale, and disproportionately affects students in disadvantaged schools (Sutcher et al., 2019). In addition, schools that are already strapped financially must bear the expense of recruiting, hiring, and training new staff more frequently than their affluent counterparts when they lose veteran staff to other districts.

Teacher Attrition. In addition to teacher migration, an additional 8% of teachers leave the profession entirely each year (Carver-Thomas & Darling-Hammond, 2017). A significant number of teachers who leave the profession are early-career educators, but research shows that teachers in all stages of their career are making the decision to walk away from the profession (Schaefer, et al., 2012). Research suggests that general unhappiness with their job contributes to teachers stepping away from the profession mid-career. The MetLife Survey of American Teachers (Metlife, 2012) consulted 1000 pre-K-12 teachers and reported job satisfaction in the profession had hit an all-time low by 2012. Factors discussed as workplace conditions that may influence early-career educators to leave the field included lack of administrator support, insufficient time for peer collaboration and professional development, and salary (Schaefer et al., 2012). Darling-Hammond et al. (2016) also listed low salaries and inadequate or undesirable working conditions as reasons that teachers leave the profession.

School leadership and administrative support are a factor in working conditions that also determines whether or not a teacher chooses to leave a district or the profession (Boyd et al. 2011). Teachers are less likely to leave their teaching position when their principals demonstrate strong leadership skills and foster an environment where their staff have the conditions needed to enable teachers to be as effective as possible in the classroom. (Darling-Hammond et al., 2016). The research conducted by Darling-Hammond et al. (2016) also lists dissatisfaction with school administration as one of the top reasons that teachers voluntarily leave the profession. Administrative support includes allowing the teacher influence over building activities and decisions, treating the teacher as a professional and teaching as a profession. When teachers report lower rates of autonomy, they generally report greater dissatisfaction in their role (Moore, 2012).

Another factor that teachers name for leaving the profession is working conditions. The school environment and student issues were named as potential reasons for early-career attrition (Boyd et al., 2011). Increased pressure to meet challenging achievement benchmarks reduce time for teachers to network and participate in professional learning opportunities (Darling-Hammond & Rustique-Forrester, 2005). In fact, demanding accountability systems are listed as the second reason that teachers leave the profession, following pregnancy and child-rearing (Darling-Hammond et al., 2016). The high-stakes standards that are used to monitor classroom progress and student growth add pressure to the role of a teacher and reduce the amount of time available for other educational activities, peer collaboration or professional development (Moore, 2012). These demands increase the pressure and stress that teachers endure in their classroom role and contribute to attrition.

Peer collaboration is an important factor that enhances teacher retention. Teachers report greater job satisfaction when they are able to collaborate with like-minded professionals who share similar goals (Darling-Hammond et al., 2016). School building culture impacts overall job satisfaction, and teachers who are happy in their role are less likely to leave. Along with time for peer collaboration, Moore (2012) names empowerment and autonomy in the classroom as critical factors in educator job satisfaction and retention.

Research shows that beginning CTE teachers leave the profession at a greater rate than teachers in non-CTE disciplines (Bremer & Joerger, 2001). Citing the extreme pressure a new teacher experiences, coupled with the wide range of knowledge and skills required for the job, CTE teachers are stepping away from the profession within their first five years at a higher rate than their more experienced counterparts (Bremer & Joerger, 2001). Leaving teaching to pursue

another profession is an additional reason that teachers name for leaving the profession entirely in their first few years.

Teacher preparedness is an additional factor in an educator's decision to leave the classroom. Teachers who feel more prepared for their role are more likely to remain in their position than their lesser trained counterparts (García & Weiss, 2019b). Research shows that teachers who are alternatively licensed leave the profession at a 25% higher rate than those who are trained through traditional teacher preparation programs (Carver-Thomas & Darling-Hammond, 2017). Though alternative pathways may be a faster route into the profession, these educators may encounter challenges that they are unprepared for, resulting in reduced job satisfaction and ultimately leaving the profession.

Though less is known about mid-career teacher retention (Hasselquist & Graves, 2020), it is an area that deserves attention when considering the teacher pipeline. Though the rate of attrition is not as high as early-career teachers, educators who leave the profession in the midst of their career also contribute to the lack of filled CTE positions (Darling-Hammond et al., 2016). Recognizing the importance of retaining these mid-career educators, Schaefer et al. (2012) recommend shifting the conversation from only retaining teachers to sustaining and supporting teachers throughout the length of their career.

Compensation also impacts the supply of teachers (Bishop et al., 2016). When coupled with low salaries compared to industry, teaching as a profession pales in comparison to other career pathways (Zarra, 2019). According to Allegretto and Mishel (2016), “Pay is an important component of retention and recruitment” (para. 2) and impacts teacher attrition across the nation. Teachers begin their careers making less than their similar-degreed counterparts, and the gap widens by mid-career; opportunities for advancement in pay for teachers also does not keep pace

with other professions (Allegretto & Mishel, 2018). Across state lines and between districts, salary and total compensation rates vary greatly, but are still generally considered to be low relative to peers in other career fields. In 2015, teacher salaries lagged 17% behind comparable employees (Allegretto & Mishel, 2016). Research shows that teachers who work in lower-paying districts are more likely to resign, therefore salaries should be considered as a means of attracting individuals to the profession and retaining them throughout their career (Allegretto & Mishel, 2016).

Strategies in CTE Teacher Retention

School districts are interested in retaining high-quality educators, partly because the financial burden of hiring and the reality of few available applicants is a hardship. Carver-Thomas and Darling-Hammond (2017) made recommendations for policy changes in the areas of teacher compensation, training and professional development, and administrative leadership in an effort to retain teaching staff, reduce turnover and increase the supply of teachers in the pipeline. A policy recommendation from research conducted by Bishop et al. (2016) is to equalize pay and ensure that wages can sustain a middle-class lifestyle.

Research indicates that underprepared teachers are more likely to leave teaching positions, creating vacancies (García & Weiss, 2019b). Of the teachers who leave, fewer have traditional state licenses than those who choose to stay in the profession. Effective training and ongoing support are critical to success in the classroom, and teachers who do not access this training are at a higher risk of walking away from their positions in the classroom. This scenario is amplified in high-poverty schools because if a combination of reduced opportunities and increased instructional demands (García & Weiss, 2019b).

Administrative leadership is a factor in teacher retention as well (Brandman University, 2020). When administrators are well-prepared for the role of supporting and developing staff, turnover is reduced (Bishop et al., 2016). In fact, the authors list administrative support as the main reason educators choose to remain in the profession or leave, with the factor being more important than pay in some circumstances.

Research demonstrates strategies that have proven effective at retaining teachers. One promising practice the literature points to is mentorship, particularly for early-career educators. Citing mentoring as a system that contributes to keeping teachers by assisting them thought the challenging first years, mentoring may reduce attrition (Zarra, 2019). Effective mentoring programs are built on relationships and interactive coaching. Building instructional capacity through professional development and honing classroom skills and strategies are ways that a skilled mentor can ease a new educator into the classroom. In addition to technical teaching skills, mentorship can impact a teacher's attitudes on the profession and students (Clark, 2001). Mordan (2012) identified mentoring as a promising practice in retaining beginning CTE teachers, specifically identifying a relationship between early-career teachers and professional mentoring.

Working conditions such as teacher-to-student ratios, instructional and classroom supplies, professional collaboration, safe facilities, and adequate support staff factor into a teacher's decision to remain at a school as well. These conditions are usually worse in high-poverty schools (Bishop et al., 2016) and contribute to overall job dissatisfaction.

Teacher Career Cycle Model

A framework that is relevant to examining the teacher pipeline is the Teacher Career Cycle Model. This model, developed by Burke et al. (1987), outlines the stages of educators as

they progress through their career. Though this path is not linear and is impacted by outside factors, it can be used as a framework to understand the progression of educator's career and the issue of teacher supply and demand. The components of the career cycle include pre-service, induction, competency building, enthusiastic and growing, career frustration, stable and stagnant, and career wind-down (Burke et al., 1987). The model proposes that a nurturing work environment encourages healthy career progression. Alternately, a teacher's career path can be negatively affected by an environment riddled with conflict and pressure (Lynn, 2002). This dynamic and winding path can be examined in conjunction with teacher recruitment and retention and may offer insight to the points in a teacher's career where customized intervention could result in retention in the field.

The Career Cycle Model begins with the preservice stage. This stage is the portion of an educator's career where they prepare for their role (Burke et al., 1987). This may take place in a teacher preparation program, an alternative pathway or while retraining for a new role. Interest in the profession has decreased, affecting this stage of the model, with enrollment in teacher preparation programs and completion rates dropping over the past decade (Will, 2018). The largest decline was in traditional teacher preparation programs, but other pathways to licensure saw a drop as well (Will, 2018).

The induction period is considered to be the first few years in a teaching role. During this time, the educator typically strives for excellence and acceptance, and works to learn the overall role and duties that are included in it (Burke et al., 1987). Research indicates that this is a time when educators are at an increased risk of leaving the profession (García & Weiss, 2019a), with attrition rates for beginning teachers the highest of any group of educators (Ingersoll et al.,

2014). In fact, research shows that over 12% of early-career teachers leaving teaching in the first two years (Perda, 2013).

Burke et al. (1987) describes the competency building phase of the Teacher Career Cycle Model as the time when teachers strive to extend their knowledge and skills for self-improvement. Teachers in this phase may work toward an advanced degree or pursue additional credentials. Attending university courses, presenting at conferences, and observing other teachers are experiences that are highly valuable and improve capacity (García & Weiss, 2019b). Effective professional development can be a key factor in retaining teachers, but limited numbers of teachers have access to strategies that have been proven beneficial (García & Weiss, 2019b). In addition to limited access, the authors indicate that less than one third of educators consider their professional development experiences to be beneficial.

The enthusiastic and growing phase of a teacher's career is when they are excited about their job and enthusiastically work to improve their courses and programs (Burke et al., 1987). Teachers in this stage have experience in the classroom and are a valuable resource to districts, but research suggests that these educators are also at a high risk of leaving the profession (Eros, 2011). One challenge that has been identified through research is that the field of education is largely made up of females (National Center for Education Statistics, 2020), and the number one reason identified for early-career attrition is pregnancy and child-rearing (Darling-Hammond et al., 2016). Because of this, attrition is a reality in this segment of an educator's career cycle and contributes to the challenge of filling teaching positions.

Career frustration happens when an educator becomes disillusioned with their career, often described as burnout. Burnout affects both new and tenured educators, with personality and job stressors as the significant predictors (Maskit & Zysberg, 2017). Some educators report short

periods of burnout while for others it continues over an extended stretch of time. During burnout, teachers often demonstrate withdrawal from work and are at risk of leaving the profession (Maskit & Zysberg, 2017).

Stable and stagnant describes the segment of a teacher's career when they simply show up and put in their time (Burke et al., 1987). These teachers are simply going through the motions to get the job done. In the mid-career stage, teachers may look back at their years of teaching and assess their profession or 'take stock' of the successes and challenges of their past work. This may be a time of excitement and preparation for the future but may also result in the opinion that they are headed for a future of 'more of the same' (White, 2008).

Finally, career wind-down is the portion of an educator's career when they are preparing to leave the profession. As Burke et al. (1987) describe this portion, it can be a pleasant time of reflecting and closing out a career or an unsettled time facing impending layoffs, career change, or unemployment. One strategy that districts are employing is to recruit retired educators back into the profession to fill open positions (Education Commission of the States [ECS], 2018), and the educators' perceptions on the profession may influence their decision to return to the classroom after formal retirement. The ECS report shows that targeted efforts and incentives are used in a variety of ways across states to pull these senior teachers back into the profession, even just for a short period of time. For this reason, data on retired educators may also prove useful in filling the teacher pipeline.

Despite the linear structure of these categories, most teachers do not progress in an orderly manner through these stages. Rather, most educators take a winding, dynamic path throughout their teaching career (Lynn, 2002). The winding path through these career stages is also influenced by outside factors, divided into personal and environmental. Personal factors are

comprised of family topics such as marriage, children, illnesses, finances and family roles, among other considerations (Burke et al., 1987). Environmental factors are comprised of school culture, management style of administration, societal expectations, and perceptions on teachers. Also included in environmental factors are professional organizations and educator support, through a union or other organization.

The Teacher Career Cycle Model (Burke et al., 1987) is a framework which outlines the career stages of educators as they progress through their career. This dynamic model allows for examination of the stages that an educator moves through on their career path in education. Understanding the times in an educator's career where supports will be most valuable, beneficial, and effective may inform recruitment and retention strategies (García & Weiss, 2019b). Coupled with accurate data, teachers could be identified and offered targeted opportunities to improve their experience and effectiveness in the classroom.

Summary of the Literature

The high demand for educators across the globe is affecting the educational field in many content areas, with career and technical education as an area of particular concern in ACTE Region III. As the literature indicates, the supply and demand of CTE teachers is impacted by the existing gaps in data in relationship to systems that track teacher recruitment and retention. This lack of existing comprehensive data on the teacher pipeline results in an inefficient way to tell if the supply of teachers is too high or too low at any period of time (Perda, 2013), potentially preventing effective strategies and promising practices from being implemented.

Teacher recruitment and retention are important to examine in relationship to the teacher pipeline. The literature indicates that overall enrollment in teacher preparation programs is declining across all teacher preparation program types, including both traditional and alternative

programs. This reduced number of individuals entering the field of education contributes to the high demand for teachers in CTE classrooms across the nation. Prior research also reported that teachers are leaving the classroom for different teaching jobs or leaving the profession entirely, creating vacancies and adding to the growing demand for high quality educators in CTE classrooms.

Research has identified factors that contribute to the high demand for qualified teachers and identified some promising practices to recruit and retain teachers. However, the lack of existing available data results in reduced opportunities to monitor the teacher pipeline in real time and respond accordingly. Examining the current educational landscape through the Teacher Career Cycle Model framework (Burke et al, 1987) will allow the researcher to consider the stages of the profession that a teacher navigates over the course of their career. This winding path offers insight into the experiences of an educator, allowing for each segment of the teaching career to be carefully considered through the lens of teacher recruitment and retention.

Chapter III: Method and Procedures

A shortage of teachers in Career and Technical Education (CTE) is problematic in the United States because students lack access to programs that have beneficial educational outcomes. The shortage is defined as the gap between qualified educators available for hire and the number of open positions. Though this topic has been at the forefront of educational conversations for years, examining this issue proves challenging because of a lack of available, relevant data on the teacher labor market (Sutcher et al., 2019).

When CTE teachers are not available to fill open positions, the opportunity for students to participate in programs is reduced. CTE programs offer benefits to learners, and a lack of offerings results in missed exposure to college and career readiness programs (Association for Career and Technical Education [ACTE], 2020). In the Association for Career and Technical Education (ACTE) Region III, which is made up of Iowa, Illinois, Indiana, Missouri, Minnesota, and Wisconsin, this teacher supply and demand issue mirrors the nationwide concern. In 2018, a lack of existing research on the CTE teacher pipeline was identified and further research was recommended (ACTE Opportunity Fund Region III CTE Teacher Shortage Project, 2019).

The purpose of this study was to examine the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III, as well as examining the ways in which data is used to address the issue of a perceived teacher shortage. The following questions were used as a basis for this study:

- What structures and systems exist to gather data on teacher supply and demand in the states within Region III, specifically in Illinois and Wisconsin?
- How are the systems and data being used to address teacher supply and demand in Region III, specifically in Illinois and Wisconsin?

- What characteristics of these systems are successful in informing strategies to recruit teacher candidates through programs completion and retention in the field?

This chapter describes the research design and methods used for the study, the subject selection process, description of the sample, research instrumentation and data collection methods, procedures used to conduct and analyze data, and limitations of the study.

Research Design

For this study, a qualitative approach was taken to research. Qualitative research is a holistic approach to research which involves unpacking experiences for the purpose of discovery (Williams, 2011). In this method, the researcher remains outside the topic being investigated while attempting to interpret the data collected. Qualitative research was selected as the method for this study in an effort to gather specific data on systems through conversations with the individuals who utilize them.

Qualitative research is conducted in a poststructuralist design and builds on inductive reasoning (Williams, 2011). Typically conducted through one of five strategies, Creswell and Creswell (2017) identified case studies and grounded-theory research as appropriate methods to research processes and systems. Because of the exploratory nature of this study, a case study design was used (Yin, 2003). Examining the current situation using case studies allowed for the researcher to gather information that contributes to the existing knowledge on the systems and structures in place to examine the teacher pipeline.

When examining the teacher pipeline, systems in place to track personal experiences in training for, working in and leaving CTE programs were explored in relationship to teacher supply and demand. Examining these systems across ACTE Region III allowed the researcher to gather the education leaders' perceptions of the systems in place that were a source of data

related to the CTE teacher supply and demand and examine how those systems support efforts to recruit and retain teachers. The research questions that framed this study lent themselves to a case study design because of their curious and questioning nature, asking “how” and “why” (Yin, 2003). The case study design allowed the researcher to examine the systems in place in real-time, in the natural environment in which they exist. Because case study inquiry deals with more variables of interest than points of data (Yin, 2003), the researcher was able to examine the different systems in place independently and holistically identify characteristics of data systems.

This study was conducted using interviews within the Midwest region of the United States, specifically within Illinois and Wisconsin. Interviews were used to gather information on systems and structures used to inform the teacher pipelines in ACTE Region III. In addition to interviews, public websites and other documents were used to gather data.

Setting of the Research

This research took place in ACTE Region III, comprised of six states located in the north central region of the United States. This region is very diverse in population and people, creating unique cultures consisting of a combination of urban and rural areas. Chicago, Indianapolis, Milwaukee, Kansas City and Minneapolis-St. Paul all boast large populations, but there are also vast rural areas that are sparsely populated with vast open plains, farmland and bodies of water (The Editors of Encyclopedia Britannica, 2021). Because of this great variance, the culture of the Midwest is a mix of urban and rural dwellers living in a broad range of community types.

Sample Selection

The target population for this research was ACTE Region III, composed of the Midwest states of Illinois, Indiana, Iowa, Minnesota, Missouri and Wisconsin. The individuals who the researcher was interested in interviewing were those who worked in or were connected to CTE

teacher preparation programs or state departments of education, specifically public and private institutions that were previously identified in the ACTE Opportunity Fund research project (ACTE Opportunity Fund Region III CTE Teacher Shortage Project, 2019). Because of the large sample size of the target population in relationship to the time and resources of the researcher, a study sample was identified to interview. Using two-step criterion-based sampling, a typical population (LeCompte & Schensul, 2010) was identified for the case study. First, the states of Wisconsin and Illinois were selected because they possessed the characteristics which the researcher wanted to study. Each state had a robust offering of varied career and technical education programs in the region. Additional requirements included that each institution had to be available to participate during the spring semester of the 2020-21 school year and each institution selected had a minimum of one functioning CTE teacher-preparation program (e.g., Agriculture, Business and Marketing, Family and Consumer Science, and Technology Education). Because of the characteristics of Illinois and Wisconsin, the researcher determined that the two states served as the study population for this research.

Secondly, individuals within the selected states were identified to interview based on their relationship to a CTE teacher preparation program or a state department of education. The researcher used public websites and personal referrals to identify individuals who had working knowledge of these data systems because of their professional role or affiliation. The characteristics that this group shared is the knowledge of or relationship to a data system or structure in Illinois or Wisconsin CTE teacher preparation program or in a state department of education.

Data Tools

The case study design selected allowed for an in-depth evaluation of the data systems that exist in the region. “Qualitative case study methodology enables researchers to conduct an in-depth exploration of intricate phenomena within some specific context” (Rashid et al., 2019, p.1). Interview questions were developed based on recommendations from the ACTE Opportunity Fund Project (2019), literature on the topic, and vetted by the research committee (see Appendix A). The interview questions were also aligned with the study’s research questions.

Data Collection Procedures

State websites and personal referrals were used to locate the Deans of the Colleges of Education that housed the CTE programs within the selected states as well as the Directors of State Departments of Education and other individuals involved in recruitment of teacher candidates and the teacher pipeline. Following IRB protocol, identified individuals were sent an email request to inquire of their interest in participating in the study (see Appendix B). Sufficient information was supplied to allow the recipient to make an informed decision to participate (Rashid et al., 2019). The researcher contacted at least one person at each CTE educator preparation program and one or more individuals at the department of education in both Wisconsin and Illinois and requested an interview. The researcher included a consent form with the interview request. If the recipient responded with consent to participate, a list of available dates and times were provided to schedule a mutually agreeable time for the interview. Upon selecting a date and time, the 45-minute interview was scheduled.

Interviews were conducted through the online platform Zoom. This method was selected in part due to the global Covid-19 pandemic, which prevented individuals from meeting in-person. Research indicates that scripting may result in the researcher to considering certain

themes or topics as “known,” thus leaving them out of a written script (Rutakumwa et al., 2019). To mitigate this, the interviews were recorded. The interviewer started by introducing the project and explaining that the interview was being recorded. The intent of the interview was to gather information on the data structures that exist within each institution selected, and this purpose guided the flow of the interview questions.

The researcher gathered data on the systems and structures that exist to track teachers in ACTE Region III during the interviews. By interviewing identified subjects, the researcher gathered qualitative data on the structures used within their university or state department to track teachers as they enter and complete programs, obtain a license and proceed to secure a teaching position. During this process, the researcher worked to remain neutral and not embrace the perspectives of the participants in the study or only report out positive or negative feedback (Creswell & Creswell, 2017). In addition, the researcher was mindful of maintaining the privacy of the participants during the interview process.

Data Analysis

The interview data was systematically collected and coded using thematic analysis. Thematic analysis allows for flexibility in research, examination of subjects in their natural setting and allows for examining unanticipated outcomes (Nowell et al., 2017). Coding is the process by which data is organized by breaking it into chunks or brackets (Creswell & Creswell, 2017) then clustering similar themes into categories. The first step in this process was data logging, when the researcher conducted interviews and compiled feedback from the respondents. Through narrative notetaking during the open-ended interview, the researcher captured the narrative and begin to identify categories that were labeled, using the language of the participants. Identifying themes allowed the researcher to find common threads throughout all

the interviews (Creswell & Creswell, 2017). As these themes were identified, the researcher recorded them in a spreadsheet and began generating a compilation of the perspectives that emerged from the interviews.

The themes identified were analyzed by their relationship to the research questions and literature, specifically examining the systems and structures that exist for data collection and the ways in which data was used to address the issue of a perceived teacher shortage. The themes identified were also considered in their alignment to the teacher life cycle model. Using the coding process allowed the researcher to describe the outcomes of the interview in great detail, creating an accurate snapshot of the systems and structures that exist in ACTE Region III. By interconnecting the themes into a narrative, the researcher was able to convey the information collected on the systems in place to track CTE teacher recruitment and retention.

Limitations

Because of the nature of this qualitative study, a limitation in this methodology was the population sample. This research was conducted on a fraction of the schools operating CTE programs in the Midwest. On a larger scale, the institutions chosen from ACTE Region III were selected for research, making it difficult to generalize beyond the Midwest. In addition, there may be programs that exist which were not considered or were not operating at the time the research was conducted.

A second limitation in the methodology was participation and responsiveness to participate in a research study. Individuals asked to participate in the study had many roles and may have chosen not to participate because of other time commitments.

Chapter IV: Findings

The pipeline of career and technical education teachers in the United States impacts the delivery of training for high-skill, high-demand careers. Without available credentialed teachers, some school districts find themselves turning away interested students because of their lack of ability to offer programs (Chen & Ney, 2020). CTE coursework provides the knowledge, skills and dispositions that serve as a foundation for future training and employability. Research has demonstrated benefits for students who participate in CTE experiences, including higher graduation rates (Castellano et al., 2016). However, teacher shortages across disciplines have been on the rise (Sutcher et al., 2019), and the lack of teachers in classrooms is detrimental.

In the Association for Career and Technical Education (ACTE) Region III, which includes Iowa, Illinois, Indiana, Missouri, Minnesota, and Wisconsin, a supply and demand issue of CTE teachers has been identified. Research conducted in ACTE Region III indicated reduced numbers of teachers entering traditional CTE teacher preparation programs. Several states in the region have been reporting CTE teacher shortages for a decade (Quinton, 2017). Throughout the region, the teacher pipeline is impacted by a variety of factors including teacher recruitment and retention.

Perda (2013) points to a lack of existing research on the teacher pipeline as a barrier to effectively study supply and demand. Examining CTE teacher supply and demand across the nation is a challenge because of this lack of comprehensive data. ACTE Region III was the focus area for previous research on the topic, and the study discovered that there was a gap in the data available on CTE supply and demand in the region. (ACTE Opportunity Fund Region III CTE Teacher Shortage Project, 2019).

The purpose of this qualitative study was to examine the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III, as well as to consider the ways in which data sources and systems are used to address the issue of teacher supply and demand. The following research questions were developed to examine the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III, as well as examining ways that the data is used to address the issue of a perceived teacher shortage:

- What structures and systems exist to gather data on teacher supply and demand in the states within Region III, specifically in Illinois and Wisconsin?
- How are the systems and data being used to address teacher supply and demand in Region III, specifically in Illinois and Wisconsin?
- What characteristics of these systems are successful in informing strategies to recruit teacher candidates through programs completion and retention in the field?

This chapter presents the findings from the participants' statements and testimony in relation to the systems and structures for data collection that are used for CTE teacher recruitment, retention in university programs, and throughout the course of their career.

Demographics

The researcher used qualitative data gleaned from semi-structured interviews with individuals who had a connection to the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III. The researcher focused on Wisconsin and Illinois when conducting the case interviews. Participants in the study included individuals involved with CTE programs at the university level and persons related to CTE teacher licensing at state departments of education. Participants were identified as being related to career and

technical education in general (CTE), Agriculture and Natural Resources (AGNR), Business, Marketing and Information Technology (BMIT), Technology Education and Engineering (TEE) and/or Family and Consumer Science Education (FCSE). Participants are listed in Table 2.

Table 2

Participants

State	Position	CTE area
Illinois	State Department of Education	CTE
Illinois	Program Director	CTE
Illinois	Department Chair	TEE
Illinois	State Department of Education	CTE
Illinois	Department Chair	AG
Wisconsin	Program Director	CTE
Wisconsin	State Department of Education	CTE
Wisconsin	State Department of Education	CTE
Wisconsin	Program Director	BMIT
Wisconsin	Program Director	FCSE
Wisconsin	Program Director	FCSE
Wisconsin	Program Director	AG

The researcher cross-examined the identified individuals to ensure participant criteria were met and that all CTE areas were represented, as well as both state departments. Participants included six males and six females. They indicated their experience in their current role ranged from 3 to 30 years with an average tenure of 15 years. University program participants included individuals involved with both undergraduate and graduate programs. Participants related to CTE teacher preparation outside of university systems included individuals from the state departments of education involved in career and technical education. No other demographics were collected as it did not pertain to the study.

Findings

The interviews were conducted and transcribed, and the results are presented here in relationship to the research questions. The researcher's goal was to examine the systems and structures that exist in the region in relationship to the CTE teacher pipeline. The findings are outlined in this chapter.

Research Question One: What Structures and Systems Exist to Gather Data on Teacher Supply and Demand in the States Within Region III, Specifically in Illinois and Wisconsin?

The supply of teacher candidates is impacted by recruitment, retention in teacher preparation programs, and retention in the profession over the course of a teacher's career. Data systems exist at each of these stages that impact the supply of teachers available in the CTE pipeline. This question investigated the structures and systems that participants identified.

Data Used to Inform the Supply of CTE Teachers: Recruitment. The U.S. Office of Postsecondary Education (2015) indicated that enrollment in teacher preparation programs is declining because fewer individuals are choosing education as a profession. This decline impacts the supply of qualified teachers in the pipeline. Individuals involved with student recruitment target potential students differently across states and within programs, and examining the data systems they use to attract students was the intent of the first series of prompts. When university participants were asked what data sources program directors and other individuals involved with recruitment used to attract students to their programs, two main themes emerged. The themes were informal and formal systems of data collection.

Formal Data Systems Used to Recruit Students. Interview participants were prompted to discuss where they found data to inform recruitment into CTE teacher preparation programs. From this, formal systems of data were identified within the universities. University marketing

services was mentioned when one participant was asked where they accessed data to recruit potential candidates into their CTE teacher preparation program. The respondent estimated that 20% of students who enter their program were captured through university marketing services. One participant shared that the university provides mailing lists, with another citing admissions as a system that pulls potential students into the programs. Others named formal university services or systems, though they did not elaborate on the data that was used from the system. No specific system of formal data collection was mentioned by more than one participant in the interviews, rather a variety of university services related to university marketing were cited.

Informal Data Systems Used to Recruit Students. When participants were asked where they obtain data to attract students to teacher preparation programs, informal data systems were identified as a system used in recruitment. The informal systems included strong secondary CTE programs and networks within CTE.

Many students who enter CTE teacher preparation programs come from school districts that have strong secondary CTE programs, participants reported. Both individuals from state departments of education and university participants reported that robust, high-quality secondary CTE programs are an important factor in the recruitment of students into teacher preparation programs. These programs engage students in CTE concepts and expose them to the content through Career and Technical Student Organizations (CTSOs). According to one interviewee, “High school CTE teachers are the boots on the ground mentors who recruit students into the program through their programs and CTSOs.” Another shared that “almost every student in the program has stated that a former teacher influenced them to pursue the profession.”

Networks within the CTE discipline emerged as a second informal recruitment system. Program graduates working in the field serve as mentors to their students and model the

profession daily, participants report. These alumni may identify students who would be good potential teachers and recommend they consider the profession as a future career. By introducing students to university programs, alumni may direct potential students into the profession. Student teachers and interns were a group identified in this informal system of networks to pull students into CTE programs. These pre-service teachers may serve as role models and persuade high school students to consider CTE as a profession. One participant indicated that "word of mouth" was their strongest recruitment tool, and that student teachers and alumni working in the field are a system they lean on to recruit students into programs. One participant indicated that they "keep in touch with alumni" in regard to recruitment, and another said they rely on "personal outreach to teachers, people I know in the field." Both program alumni and student teachers serve as an informal data network that connects students to university programs and impacts the pipeline of incoming teacher candidates.

Documentation of Efforts to Inform the Supply of CTE Teachers. Participants were asked to describe how their recruitment activities and results were documented. Throughout the recruitment process, documentation of efforts by individuals facilitating the process is handled in a variety of ways. From this prompt, the responses aligned with three themes: informal documentation, no documentation, and barriers to documenting recruitment efforts.

The first theme that emerged among participants in the study was that maintaining personal records on their recruitment efforts was their main documentation process. Four of the eight participants involved in recruitment indicated that they informally or casually documented their recruitment efforts. Program department heads stated that institutions may track data on recruitment but indicated that this was not necessarily relayed back to the departments or used by the departments. Several indicated that although someone at the university level likely collects

the data, they did not know who that person would be or where to access that information. One participant indicated that “I think someone collects that data, I could probably track it down.” Similarly, the program directors did not report sharing data on their recruitment efforts back with the university. One respondent stated that they collected information they thought was valuable to inform their program, and that the information collected may change annually based on what they want to know about the program. The responses to this prompt identified an informal, local system of documentation to track recruitment efforts.

Despite reporting a great deal of recruiting activities, a theme that emerged was a lack of documentation of efforts. Four of the eight interviewees involved with recruitment reported not documenting recruitment activities at all. One reported “I don’t have a system to formally document the students that I talk to.” Another shared, “to recruit teacher candidates, I attend conferences such as WTEA. I work with admissions and do some personal outreach to teachers and people that I know. None of this is documented, at least not that I know of.” Another participant reported “I’m just not good at documenting it.” In addition to lacking personal documentation, respondents indicated that they did not typically submit any information to the university regarding their recruitment efforts.

When asked about documenting efforts, time constraints was named as the primary factor preventing participants from documenting their recruitment efforts. One program director said “between teaching and all of the other demands, I don’t have time to do that! I would if I had the time, but I don’t.” Another respondent indicated that they did keep detailed records of their students and alumni, but that it was becoming “less and less manageable” as the years went by and the number of individuals to keep track of had grown quite large. One program director indicated that if they had more release time, they would be able to gather data to recruit and

better track their recruitment efforts, but that they currently were not able to do much. In the recruitment process, it became apparent that time was a barrier to documenting recruitment efforts in CTE teacher preparation programs.

Data Used to Inform the Supply of CTE Teachers: Retention in Programs. The second series of prompts related to the first research question encouraged interview participants to talk about their relationship with data systems as a teacher candidate moves through their university teacher preparation program. Retaining teacher candidates in preparation programs is a component of the CTE teacher pipeline. Across the region, the strategies used to follow students from enrollment to completion of CTE teacher preparation programs varied, and the systems in place to track these students were equally diverse.

In some programs, students engaged with the CTE teacher preparation program director at the onset of their experience. Other participants related to university programs indicated that they did not meet program concentrators until a student's second or third year in the program. The participants who indicated they do not meet students until later in the program cited university onboarding and advising programs designed specifically for freshman and sophomore students as the reasons they did not have contact sooner. Some participants indicated that they had a good pulse on the students who were in the program from a personal relationship and others stated that the college had a system of tracking students as they progressed through the program, while others indicated both systems were in place. The interview prompts for this research question generated a variety of responses related to retaining students in teacher preparation programs, and the concepts fell into two themes: formal and informal systems of data collection.

Formal Systems of Data Collection: Retention in Programs. When respondents were asked to describe the data that was collected throughout the course of a potential teacher's education, individuals identified formal systems of data collection. University-based tracking systems and state departments of education were cited as formal systems where data on student retention in programs was held.

Five of the twelve respondents indicated that their university was good at tracking data, specifically information on retention in the university and retention within programs. One individual was heavily involved in the data collection process, tracking students coming in and progressing through the programs as names and numbers. Though there was no personal relationship — "the students don't know me, and the tracking doesn't affect them"— this individual shared that their institution tracked enrollment data, test scores and other benchmark information that is relevant to a student progressing towards graduation. A participant indicated that their university maintains a report related to accessing materials and another indicated that their institution had a planning committee that collected data. Another reported that their institution required bi-annual reporting, but the participant did not provide details on the content of the report. The state department of education was named by one participant as an agency that collected information on teacher preparation programs. No report or agency was named more than once in reference to data collected to track students through university teacher preparation programs.

Informal Systems of Data Collection: Retention in Programs. When discussing the systems in place to track students in programs, informal systems of data collection emerged as a theme. Individuals related to CTE programs indicated that the data they have access to is due the small size of their program and through personal relationships with students. These informal

systems allow for program directors and university contacts to track the progression of students through programs.

When students move through programs, many participants in this study reported that the data they collected was not linked to university data systems or made publicly available. Rather, information on retention in programs was gathered informally because participants indicated that they know their students personally. One participant stated that their students were in class with a teacher from the program their first year, so they got to meet the students right when they began college. Another cited an introductory course as a way of connecting students with program staff early in their college experience. One participant called this process "relational," stating, "We advocate for our students. Relationships are important. We want them to feel comfortable."

These relationships are built through a variety of systems across campuses. Of the nine participants who were connected to university programs, four indicated that their program staff served in an advisory role. These typically included weekly or monthly meetings, with one program director stating that they saw value in having "one male and one female advisor, because students typically relate to one perspective or the other." These advisement meetings serve as check-ins and were identified by participants as a system to monitor student progress as they move through the program. Many of the participants indicated that the records they kept on student progression through the programs were "kept in-house," within their department and not shared with the university in any way.

Data Used to Inform the Supply of CTE Teachers: Retention in the Profession. The third and final series of prompts designed to address the first research question focused on data systems to track program completers after graduation. Participants described the data that they

used to follow graduates of CTE teacher preparation programs as they obtained a teaching license, entered the profession and carried out their career. The themes that emerged were formal systems of tracking completers, informal systems of tracking completers, and barriers to tracking completers. When participants discussed the barriers to following program completers throughout their career, the subthemes that emerged included challenges to tracking completers and a desire for more data.

Formal Systems of Data Used to Inform the Supply of CTE Teachers: Retention in the Profession. Participants identified formal systems that track program completers after they leave the university and enter the profession as state databases and university alumni programs. Seven of the 12 participants referenced a state website as a place where data on teachers in the field is held. Each indicated that they had access to this data. Of the seven, three shared that they used the data available regularly.

University alumni services were identified by participants as a system where program completers are tracked upon program completion. Alumni relations and career services were mentioned by interview participants, but none of the respondents indicated that they accessed or used this data. Several participants indicated that the focus of the alumni outreach was fundraising for the university, and that the data collected was not useful in informing program improvement or the teacher pipeline. In addition, one interviewee stated that the information gathered from alumni is self-reported, indicating that it is not a truly reliable or representative sample. One participant indicated that alumni services tracked graduates, but that after 5 years, “nothing more is done” to follow completers. Others indicated that their institution gathered alumni data for longer than 5 years, but also stated that they did not access that data.

Another participant indicated that the university maintains an alumni database, but that they have trouble keeping updated, accurate lists.

Informal Systems Used to Inform the Supply of CTE Teachers: Retention in the Profession. When prompted to describe the processes used to track completers, an informal system of tracking was a theme that emerged. Informal systems included relationships and professional development networks as a subtheme. One respondent stated "We know where our students are because we know them personally, we keep in touch. They are friends, we see them at events and shake hands." Another respondent indicated that students typically stay in touch initially because the university is a pipeline into jobs and a contact for letters of reference. "Typically graduates keep in touch from years one through four because they are in the early part of their career where they may be moving around, looking for a job closer to home or a more desirable position."

When asked if they checked to see if students obtained a teaching license after graduation, informal systems of tracking emerged again. One individual indicated that "we know where people are, we keep in touch. If they are teaching, we know they got a license." Another stated, "It is very informal tracking, we may see them at a conference, catch up and learn where they are working." Another respondent cited the power of personal relationships in the CTE community by sharing that they were recently contacted by a job-seeking student who graduated twelve years ago.

Challenges to Tracking Program Completers: Retention. Retaining teachers in the profession is a factor in the supply of qualified CTE teachers. Teachers leaving positions burden districts with the costly and time-consuming processes of recruiting and hiring. When prompted to talk about their efforts to follow program completers throughout their career, challenges were

consistently mentioned throughout the interviews. When asked about data systems used to track teachers, participants pointed to barriers to accessing information. One respondent stated that she typically knows who got a license because she knows where they are teaching, but “some go to another state, and then I guess I don’t know.” Another identified the same challenge, sharing “Every state has their own data, and only has access to their own data.” Time consuming systems and outdated websites were barriers identified, along with the inability to locate program graduates who did not go on to obtain licenses or work in the field. One participant indicated that some program graduates go to business and industry before considering returning to teaching. “Those who do not teach initially, we try to reach out to them, see if they would consider it now. But obtaining contact information for those who have went to business and industry is hard.

Data Used to Inform the Demand for CTE Teachers. One interview participant indicated that “The demand for more CTE teachers is there, but I am not sure the pipeline is as robust as it should be.” A participant from Illinois stated that the demand for teachers is so strong, students will self-recruit to a particular CTE program. “They know that if they get a degree, they are ‘gold’ and they can pretty much pick where they want to teach.” Another participant cited their “dying program” while a state department participant indicated that “we need more kids to consider CTE.” Others reminisced of times gone by, recalling robust enrollments and large program sizes. One stated, “now, recruiting is tough” and another said, “the profession is in jeopardy.” Program directors reported that they field a great deal of calls and emails from individuals searching for a teacher to fill a vacant teaching position. These staffing challenges are a direct result of fewer students completing traditional preparation programs (Zarra, 2019). One participant said that losing teachers to the private sector was a reason for the high demand, while others pointed to a lack of recruitment into programs.

The problem, one participant stated, “is multi-pronged,” and another program director called this a regional issue, stating “We need more teacher candidates. It’s not just our problem, other states have the same issue.”

This strong desire for more information on teachers who have completed programs and left the university was evident throughout the interviews. One respondent simply stated, “I wish something existed,” citing individuals who may be certified and available to teach, but not currently working in the system. Research indicates that teachers leave the profession for a variety of reasons, creating a shortage of available teachers in the pipeline. Boyd et al. (2011) indicated that working conditions and student issues contribute to teacher attrition, while García and Weiss (2019a) point to low salaries in comparison to industry. One interview participant from a university program estimated that 40% of program completers are recruited into business and industry upon program completion, never entering the educational field. “Perhaps the wages offered are more attractive,” one participant mused. They state that “these individuals could be pulled back in, perhaps later in their career, if we knew where to find them.” Another interview participant shared that they would appreciate a way to track all teachers in the workforce, not just those traditionally trained. Darling-Hammond and Carver-Thomas (2017) report that alternatively trained teachers leave the profession at a higher rate than their traditionally trained counterparts, resulting in a reduced supply of teachers in the pipeline.

Teacher Demand: Gap in Data. A lack of available data to address demand for CTE teachers was the most prominent theme that emerged from the interviews. Participants from the state departments of licensing and university programs both expressed interest in where graduates worked throughout their career, indicating that access to this information could impact the teacher pipeline. When asked how completers from their programs were tracked, many

respondents indicated that they did not have that data and were not sure who did. One participant indicated that there was a state database to track completers, but that it was not updated often so the information was usually outdated. About the system, they said “It’s not getting better.” Another participant considered the state department of education’s website as a resource to locate program alumni but indicated that the system was time-consuming to use in a productive manner. “You can try to look for someone specifically, but it’s not a realistic way to follow program completers through their career.” Another shared, “we need a system that tracks completers. Where are they going when they leave us, did they stay in the pathway?” The desire for a more robust system of tracking teachers in the pipeline was a topic that over half the participants shared in their interview.

When prompted to discuss ways that data on the teacher pipeline was used to inform retention of CTE teachers, a state department participant said, “More data would be nice to have.” Name changes and individuals relocating were cited as challenges to tracking graduates of teaching programs, contributing to the gap in data. A participant pointed to another factor that resulted in a disjointed system, “the inability for the state to use social security numbers to track program completers. The state readily admits that tracking completers is a problem. We don’t have the data.”

Research Question Two: How are the Systems and Data Being Used to Address Teacher Supply and Demand in Region III?

The second research question prompted interviewees to consider the ways that they interact with and use the data they have access to in relationship to the teacher pipeline. Discussing both formal and informal systems, participants shared how they access and use the systems in place that impact teacher supply and demand.

Formal Systems being Used to Address Teacher Supply and Demand. When participants discussed the data systems in place to inform teacher supply and demand, formal systems were identified. These systems included state, university, and independent databases as well as CTSOs, conferences and professional development.

State Systems. Some state departments maintain formal systems to track teachers throughout their careers. Participants from universities addressed these systems throughout the interviews, but participants indicated that these databases were not a place they typically went to track a teacher's progress. One barrier named in this circumstance was the time it would take to search for each licensed individual on the state site. "I know the data exists on the state website, but I don't have time to look up everyone just to see if they still hold a license. And that doesn't tell me where they are or if they are even teaching." Two participants shared that they attend graduation annually and save the programs, stating that they could pull those out if they needed to generate a list of program graduates. However, time was again noted as a barrier when this method of locating alumni was discussed in the interviews. CTE teacher supply and demand are difficult to monitor based on the data available from state systems, according to participants.

One participant indicated that each state holds its own records, but the states do not share data between one another. "A license clearinghouse would help, allowing teachers to cross borders with their license and keep credentials across states," a participant indicated. Another participant indicated that their teaching college tracks some data, but the data relies on the state website, which they consider to be "not desirable." Darling-Hammond et al. (2016) pointed to the need for comprehensive data and demographics as a component of effective recruitment and retention strategies, a sentiment that was echoed throughout the interviews. One participant said, "It would be better if the data sources were tighter. By tighter I mean I could go online

somewhere and find out where interested students are, where to recruit. Could I find teacher candidates at community colleges? I'd like to. But that would require one data system, where we all report to one source." Another reported "undergraduates are not finding their way into programs. We need to leverage a broader system." Recognizing the need for a more comprehensive system, the National Governor's Association (2020) called for the development of statewide data systems to collect labor market information to inform the workforce, a recommendation that participants mirrored in their interviews.

One participant indicated that state databases exist which allow them to look up student information. Using it, they could see if they obtained a license and if they maintained it a few years into their career. The other four participants who addressed the state database only identified the sites as a place where the data existed but indicated that they did not regularly access it. One participant said, "I could look them up on the state website, but I don't" and another reported "The state maintains a database where I could look them up, but that would be very time intensive to do." Another said they considered the state database "an unproductive way to find data." Another replied that "the state database is not as robust as it used to be. It's not getting better. It is updated annually, they say, but it is not reliable. It's likely outdated information." The impact of disjointed systems is preventing individuals involved with CTE teacher recruitment, retention in programs, and in following completers throughout their careers from accessing data to inform their efforts.

University Systems. Universities maintain various contact information on graduates, but survey participants indicated that it is not heavily used by individuals in the CTE teacher pipeline. One participant shared that their university produces an annual report, and that "I could probably dig into that if I had to." Another reported, "the University maintains a database, but

they have a hard time maintaining accurate lists." This same respondent shared that the data available had a noticeable delay, stating that "it's about a year behind."

Although many respondents addressed some sort of data system that they had access to or knew about, few reported that they relied heavily on them. Some named were university marketing, alumni services, Golden Apple, and an Academic Planning Council. Universities also often conduct alumni surveys at various points after graduates leave the institution, but most of the individuals interviewed did not consider this information to be useful in following up with individuals in the profession. Few participants indicated heavily using or accessing these data systems as a means of tracking students as they progress through teacher preparation programs. Individuals connected to university programs reported that the institutions followed students and that data was collected, but that this was not something they accessed regularly or contributed to.

Participants discussed the challenges of universities gathering information from graduates after they leave the university. Contributing to this is individuals getting a new email address, relocating and potentially changing their name. One respondent said, "Once students leave campus, I don't have access to them."

Other Data Systems. Individuals addressed data systems that were outside of the university and state systems throughout the interviews. One individual discussed a private company that had been piloted to track data, but said the program is "a lot of money for a low response rate." Another indicated that their admissions department was piloting a program, but they did not know the name of the program and indicated that they do not use the data. A program director referenced the National Association of Agricultural Educators (NAAE) campaign, #teachAg, as a successful strategy to recruit students into the profession and engage

them throughout their career. Another participant said “the TeachAg movement is good.” A program director shared that their department had participated in a state and national initiative related to teaching technology education but did not indicate current involvement. One participant said that the Association for Career and Technical Education (ACTE) tracks individuals who are endorsed to teach, indicating this may be a place where the data on the pipeline could be accessed.

Accrediting agencies were discussed during the interviews, but participants did not indicate that they heavily relied on or used any of that data. In addition, several respondents referenced accrediting data but indicated that they did not have access to it. One interviewee said, “The Council for the Accreditation of Educator Preparation (CAEP) tracks them, but I don’t have access to that data.” Another addressed CAEP but said their institution did not engage with the agency. A program director said, “We need a system that tracks students. Where are they going? Did they stay in the profession?”

CTSOs. Through the interviews, the structure of CTSOs were identified as a system to connect students with the college environment. CTSOs were named as a recruitment tool that contributes to the supply of CTE teacher candidates. One participant indicated that “historically, CTSOs have been the best recruitment strategy” and another reported that “CTSOs make students in the program visible to high school students through judging and other activities at events.” This network was identified as a system used for recruitment of students into teacher preparation programs. One participant said “CTSO students get out in the classrooms and work with high school students, serve as mentors,” with another indicating that “CTSOs are a recruitment tool.”

Conferences and Professional Development. Conferences and other professional development events were named as a system that exists within the CTE community. Program directors and others said they depend on this system of professional development opportunities to keep in touch with alumni, a connection that they rely on when recruiting students into programs and placing student teachers. Connections at these events lead to program directors and others related to recruitment visiting classrooms to talk about university programs, obtaining a list of interested students to target, and opportunities to disseminate program information. Individuals related to CTE teacher preparation programs at the universities also attested to leaning on alumni to present at conferences and return to campus for professional opportunities.

Throughout the interviews, professional development emerged as a place where individuals related to CTE programs and program graduates connect. Darling-Hammond et al. (2016) reported that an educator's job satisfaction is increased when they are able to collaborate with like-minded professionals who share similar goals. One participant referenced professional development events by sharing, "I see people at conferences, we keep in touch." Another participant noted that many CTE teachers worked as a one-person department, citing the importance of the larger community network of teachers that congregate at conferences and events. "This connection builds a sense of community and the teachers don't feel so alone." Peer collaboration is an important factor that enhance teacher retention, and professional development is a system that facilitates these interactions.

Informal Systems being Used to Address Teacher Supply and Demand. Throughout the interviews, it became apparent that informal systems were used to inform CTE teacher supply and demand. When asked how they addressed the teacher pipeline, participants cited

personal relationships and small programs as networks that allow them to stay connected to the CTE teacher pipeline.

Personal Relationships. To inform recruitment, university program directors indicated that they were connected to high school CTE programs by personal relationships to the teachers. Many of these teachers are program alumni, have served as a cooperating teacher, or are a colleague through professional development. Relationships with teachers in robust CTE programs, participants indicated, allowed for targeted marketing, and offered recruiters a direct pipeline to students who may consider CTE as a future career pathway.

Small Programs. Small teacher education programs were named as a structure that contributes to the CTE teacher pipeline. “When 12, 13 students move through the program annually, I can keep track of them. I know them, the teachers know them. We check in and make sure they are where they need to be for a GPA, benchmark testing.” Another respondent stated that the program was small, so the teachers know where the students go if they transfer out of the program or where they come from if they transfer in. Yet another stated “Our lower numbers allow us to stay connected with our students.” One program director indicated that although there were a handful of instructors, “I’m the only program director, so I know where all the students are. It’s just me.” Because they knew the students in their programs personally, participants indicated they could keep track of their progress by relying on informal documentation. One respondent said they tracked students “Not formally, not on paper. It’s just me so I see the students, I know where they are in the program.” Another described their system of keeping tabs on students in the program as “notes, running lists.”

Gap in Teacher Supply and Demand Data. A gap in data was identified by participants as a theme related to monitoring teacher supply throughout the course of an educator’s career.

After students graduate, it can be a challenge to keep track of them and monitor their progress as they leave the university, participants stated. A participant related to the state department of education discussed tracking teachers through their careers, saying “It would be nice to have touchpoints with our CTE teachers throughout their experience.” Another interviewee stated that although completers were tracked by accrediting agencies, the university did not have access to graduates after they left the university, making tracking and data collection across an educator’s career a challenge.

When prompted to talk about the data that they used to track graduates, many participants named challenges or barriers to maintaining contact with individuals. One participant described the process of keeping in touch with former students “like climbing through a rabbit hole to find contact information.” Changing last names and other identifying information is an additional challenge in locating people once they graduate and leave the university. One respondent noted that “if someone gave me a list of my former students, I would reach out to them and stay in touch. But people are hard to get ahold of and it’s difficult to locate email addresses. If I had that list, I would have more touchpoints with graduates.” Another stated that if they had time, “I could do outreach and track many of these people down. I have enough contacts that I could likely find many of them.” Individuals reported the systems that they have access to are a barrier that contributes to the gap in data. Specifically, they pointed to systems that do not share information or work together, making them time consuming and cumbersome to navigate.

The impact of individuals not having access to data systems or not using the data that is available results in potential teacher candidates being left out of the pipeline. Regarding recruitment, participants indicated that there are students they are not reaching at the high school level because they do not have access to the data on where to locate them. One shared that “if I

had lists, I would use them to reach out, but I don't have that information." The relationship with 2-year colleges was addressed, with a participant indicating the systems to locate potential students and then successfully transfer them into a teacher preparation program is challenging. Another indicated that they could look up all the high school programs in the state and reach out to teachers to try to locate interested students but said that that would be too time consuming and unrealistic to execute.

The impact of data systems that are nonexistent, not functioning, or unused also impacts the teacher pipeline when program completers and other non-traditionally trained teachers cannot be located once they leave the university. One participant indicated that "I don't think there is a shortage of licensed teachers. But finding them is a challenge. There are many that are employed in business and industry, but we are not finding them." Another indicated that there needs to be a better way to track all teachers, not just those traditionally trained. And "the system needs to be inclusive of all people who fit the criteria to teach," citing those with an emergency license as a growing population of teachers filling positions.

Research Question Three: What Characteristics of These Systems are Successful in Informing Strategies to Recruit Teacher Candidates Through Program Completion and Retention in the Field?

Participants were asked to describe the components of systems that they feel are beneficial in informing the teacher pipeline. The prompts for this research question encouraged participants to think about the components of systems that are successful in recruiting students into the teacher preparation programs, retaining them in programs, and following completers throughout the course of their career. The participants shared systems that they have used in the past, are currently piloting, or are actively using. The researcher also prompted participants to

consider systems that would be ideal, what they thought would exist in a “perfect world.” The themes that emerged from these conversations included strategies in both informal and formal data systems related to the teacher pipeline. The formal systems identified included CTSOs and professional organizations, and informal systems included personal connections and program alumni.

Successful Strategies in Formal Systems. Components of formal data systems were identified as successful strategies that could expand the teacher pipeline, participants indicated. Interview respondents indicated that CTSOs and professional organizations were two formal structures that they found beneficial.

CTSOs. CTSOs were a formal system that participants considered successful to recruit students into programs. CTSO advisors were identified as a direct pipeline to students who are already engaged in CTE topics and may be interested in a future career as an educator. Student participants may be more likely to consider the profession because of a relationship with a CTE teacher or CTSO advisor. Additionally, the group was considered to be more accessible because they could be identified by their advisor or instructor. Participants indicated these students may attend events on campus or participate in a professional organization. According to interview participants, teachers could share their CTSO student lists with university program directors, giving them access to an “already interested” group.

CTSOs, it was reported, often hosted events on college campuses, resulting in students visiting the institution and becoming familiar with the university. While the students were on campus, individuals involved in recruitment may have an opportunity to connect directly with these students or provide opportunities for students to seek out more information on CTE teacher preparation programs. Participants reported that these activities are a great recruiting tool

and good way to make an interested group of students aware of campus teacher-preparation programs.

Professional Organizations. Another formal system that emerged as a theme in response to this research question were professional organizations. Individuals cited professional organizations as a means to keep in touch with colleagues across their careers. In this research, they identified the organizations as a successful strategy for retaining teachers in the field by offering a professional network of support and professional development. Often, they indicated, there may be only one teacher in each CTE discipline in school buildings, and professional organizations provided a peer network and opportunities to collaborate with like-minded educators.

Successful Strategies in Informal Systems. Informal data systems were also identified by participants as structures that offer positive outcomes in relationship to the teacher pipeline. Participants embraced personal connections and networks as a system that is beneficial in informing strategies to recruit teacher candidates through program completion and retention in the field

Personal Connections and Networks. A personal connection was addressed as a critical factor in recruitment, retention in programs and in following completers throughout their careers. At each stage, individuals tied to career and technical education teacher preparation programs cited a personal connection as an important factor. One participant indicated that when this personal connection is lacking in recruitment, universities lose out on potential teacher candidates. The individual believed that talking to a program director or professor in the program would likely result in a greater rate of enrollment, stating “University websites often have a generic place where students can request more information on a program. This contact form

results in a generic campus representative contacting the interested student. It should be someone from the program reaching out to that student, to have a conversation and answer questions." Rather than an impersonal campus tour or speaking with an admission representative, many individuals in leadership roles at the university level felt that recruitment through a personal meeting or conversation was a powerful strategy to attract students to programs. "By building this personal relationship, you make them feel like this campus is home," a program director stated.

Another participant pointed to a recruitment position that had been eliminated on campus, expressing concern that the loss resulted in reduced student outreach. "The personal touch has gone away as a result. To recruit students, especially multicultural students, we need a personal relationship, tutoring and outreach." A participant brought up the difficulty of finding contact information for program directors or program contacts on university websites, stating that "students do not want a generic contact form, they want to talk to someone about the program and ask questions." Another shared, "Students might engage if they talked to an actual person in the program, made a personal connection." Some participants indicated that their ability to have a personal, one-on-one conversation with students doesn't happen until they are enrolled in the program. One respondent stated that if they were able to get a list of interested potential students it would be helpful, noting that a conversation with a potential student often results in answered questions and subsequent enrollment in the program.

Other Findings

Throughout the interviews, an additional theme emerged across the interviews. Individuals related to CTE discussed the manner in which educators and the CTE community talk about and market the role of teaching. Several participants indicated that "we need to value

the profession" and one participant said "how current teachers talk about the profession is a challenge. They need to be a voice of encouragement. Some still talk negatively about the profession, still based on the impacts of Act 10." Another said "For CTE to flourish we need young people to see education as a valued profession." The perceptions of education, and specifically CTE education were addressed by three of the 12 participants. Aragon's 2016 research included a policy recommendation in Arizona to "publicly acknowledge the value and need for teachers (p. 8)." A state department participant indicated that "We need to get our CTE teachers talking to kids about teaching as a career option. Pushing the students into the profession, talking to them positively about their position and encouraging them to check it out."

Testing as a barrier to teachers entering the profession emerged as another theme in the interviews. One participant cited the edTPA test as time consuming and expensive. The same individual addressed benchmark testing as a barrier to students completing teacher education programs. "If individuals can't pass the tests, they transfer to other programs," one university participant indicated. The same participant continued on to say, "They probably would have been good teachers, but they leave the program because of the burdens of testing." A program director said they made a point to connect with students prior to them getting to the stage in their education where they take specific tests, indicating that their GPA and test scores will influence their ability to progress into the school of education. Testing is necessary, participants indicated, but losing potential teacher candidates because of the burden of testing was mentioned in five of the 12 interviews.

Pathways to licensure was another theme that came from the interviews. Participants indicated that the way teacher candidates enter the field has changed. Research shows licensing changes to grant flexibility and remove barriers to entering the profession (Aragon, 2016). One

participant stated that licensing has loosened up as a way to fill the pipeline, and another said that when they looked into the number of teachers entering the profession on emergency or temporary licenses, the number was startling. A participant from the state department said that "we need to embrace experience-based teachers more than ever before, embrace all the folks that want to be teachers, regardless of their preparation programs." It became evident across the interviews that individuals were interested in using multiple pathways into CTE to build the supply of teachers in the pipeline.

Chapter V: Discussion, Conclusion, and Recommendations

Career and Technical Education (CTE) prepares students for life by providing a pathway into the workforce. The discipline has positive outcomes for students and the workforce (ACTE, 2020). However, providing high-quality CTE experiences for learners requires trained teachers to fill classrooms and deliver educational content. A lack of CTE teachers results in reduced opportunities for learners to participate in CTE courses and related programming (Chen & Ney., 2020).

CTE teacher supply and demand is impacted by a variety of factors. How teacher candidates enter the profession is one component of teacher supply. The U.S. Office of Postsecondary Education (2015) reported the enrollment in total teacher preparation programs dropping from 719,081 in the 2008-2009 school year to 499,800 in 2012-2013. Nietzel (2019) found that fewer high school students were interested in teaching as a career, and Darling-Hammond et al. (2016) predicted this trend would continue. Despite declining enrollment in teacher preparation programs, there is demand for trained CTE teachers in the field. With reduced numbers of students entering preparation programs, there are fewer available teachers entering the pipeline. This reduced supply of qualified educators results in unfilled positions and reduced student opportunities in CTE (Devier, 2019).

Retention in teacher preparation programs is a second factor affecting teacher supply and demand (Zarra, 2019). Teacher candidates who enter preparation programs but do not complete them impact teacher supply by sending fewer prepared teachers into the field (Bishop, 2016). While progressing through teacher preparation programs, potential teachers must complete varied tasks, courses and testing requirements that the university and state departments require for certification and licensing. Darling-Hammond et al. (2016) suggested that these requirements

may encourage students to explore career opportunities other than teaching. Candidates leaving preparation programs results in reduced numbers of graduating teachers (Zarra, 2019), and this means there are fewer available individuals to apply for and fill open positions. These vacant positions result in reduced CTE learning experiences for students.

Upon graduation, a teacher candidate can choose to obtain the appropriate licensure to teach, a requirement to enter the profession. At this point, program completers decide whether to apply for a license and take a job in education or in the private sector. Graduates may be drawn to the public sector for higher pay or increased opportunities for advancement (Nietzel, 2019). The graduates who decide to work outside of education reduce the supply of available trained teachers in the pipeline. Others obtain the necessary license and take a teaching position, but later choose to leave the profession (Carver-Thomas & Darling-Hammond, 2017). Each potential teacher who chooses to leave the position, at any point in their education or career, contributes to the high demand for qualified teachers. This situation has been compared to a leaky bucket (Carver-Thomas et al., 2016), a condition that results in missed opportunities for students and the workforce. Before the issue of teacher supply and demand can be comprehensively examined, it is important to consider what information is available and how it can be used to inform strategies and solutions.

A CTE teacher supply and demand issue has been identified in the Association for Career and Technical Education (ACTE) Region III, which includes Iowa, Illinois, Indiana, Missouri, Minnesota and Wisconsin. Throughout the region, teacher supply and demand is impacted by a variety of factors including teacher recruitment and retention. Reduced numbers of teachers entering and completing traditional CTE teacher preparation programs has resulted in CTE teacher shortages. Teachers leaving the profession at an increasing rate also impacts supply and

demand in the region. A gap in existing comprehensive data on CTE teacher supply and demand is a barrier to effectively study this issue in the region (ACTE Opportunity Fund Region III CTE Teacher Shortage Project, 2019).

The purpose of this study was to examine the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III, as well as examining the ways in which data sources and systems are used to address the issue of teacher supply and demand. The researcher was interested in learning:

- What structures and systems exist to gather data on teacher supply and demand in the states within Region III, specifically Illinois and Wisconsin?
- How are the systems and data being used to address teacher supply and demand in Region III, specifically in Illinois and Wisconsin?
- What characteristics of these systems are successful in informing strategies to recruit teacher candidates through programs completion and retention in the field?

The researcher collected qualitative data through interviews with individuals connected to the CTE teacher pipeline in ACTE Region III, specifically in Illinois and Wisconsin. The interviews sought to gather information on the data systems that participants used and had access to. The case study design allowed the researcher to gather insight on the participants perceptions of the systems in place in regards to their usefulness. Twelve interviews were conducted using an online platform, partly because the research was conducted during the Covid-19 pandemic. The interviews were recorded, transcribed, and coded using thematic analysis. The themes were then analyzed by their relationship to the research questions and compiled to allow for examination in relationship to the CTE teacher pipeline.

This chapter includes discussion on systems and structures that exist to inform CTE teacher recruitment, retention in university programs, and following completers throughout the course of their career. In addition, recommendations are made for further research on CTE teacher supply and demand.

Discussion

Systems and structures that collect data on teacher supply and demand are an important factor in examining the teacher pipeline. To recruit students to university teacher education programs, retain teacher candidates in preparation programs and follow individuals throughout the course of their career, this study found that there were formal and informal data systems in place which impact the CTE teacher pipeline. Individuals involved with the CTE teacher pipeline interact with these systems in a variety of ways across the region. Components of these systems were identified as effective in informing CTE teacher supply and demand, while other parts of the systems proved to be barriers to accessing information that could be used to increase the supply of available teachers in the pipeline.

Systems that Influence Recruitment to Teacher Preparation Programs and How They Impact CTE Teacher Supply

Recruitment efforts are an important factor in the supply of teacher candidates in the pipeline. Recruitment into preparation programs was the first and foremost way that traditionally trained teachers entered the profession, this study found. A drop in both high school student interest and enrollment in teacher preparation programs (Aragon, 2016) has resulted in declining program enrollment (Nietzel, 2019), as high as 70% in some states (Darlin-Hammond et al., 2016). Individuals in this study who were involved in student recruitment described the data they used to attract students to their CTE teacher preparation programs, indicating that they rely on

formal and informal systems to obtain information on potential teacher candidates. Perda (2013) reported that examining the teacher pipeline is a challenge because of a lack of existing data, and participants in this study reported the same. The data that individuals identified as being useful included information on high school programs where they could direct recruitment efforts, connections to teachers in the field, and tangible lists of interested students. The data individuals were interested in was qualitative information that would allow them to contact potential students regarding their programs. Rather than aggregated data on the CTE teacher pipeline overall, these individuals indicated a desire for concrete information that could be used to access students who may consider teaching CTE as a viable profession. Darling-Hammond et al. (2016) pointed to a need for data and demographics on teacher supply and demand in order to effectively implement recruitment strategies. With data, individuals involved with CTE teacher recruitment reported in this study that they would be better equipped to attract potential candidates to their programs.

Formal systems exist to track teacher candidates and graduates. The National Center for Education Statistics (NCES) conducts the Integrated Postsecondary Education Data System (IPEDS) annually, but participants in this study indicated that they do not rely on the information from the system. Some participants in the study said they relied on data from systems such as university marketing to obtain recruitment information, but this was not the main way that they were accessing data to inform recruitment. These larger data systems were reported to be clunky, time consuming or lacked relevant data. Citing a lack of time to dig through these formal systems in search of information to inform recruitment efforts, many participants indicated that they preferred to use informal data systems when recruiting to their programs.

Because the formal systems in place were not where individuals involved with the CTE teacher pipeline reported they were finding data, personal networks are where participants in this study indicated they were gathering information on teacher supply and demand. To pull students into their teacher preparation programs, casual connections to alumni or professional connections in the field were where many program directors indicated that they got information. It was through these smaller, informal data networks that individuals in recruitment roles connected with interested students, citing a personal connection to others in the field as the system they used to inform the CTE teacher pipeline.

Individuals in this study were proud of the personal network of peers and colleagues that they reported relying on to recruit students to their program. This might be a Family and Consumer Science program director at an Illinois college reaching out to a former student at a nearby high school to arrange a campus tour. It might also be a program manager for an Agricultural Education program connecting with a student teacher in the field to encourage them to talk to their students about considering the profession as a career. These activities, it was reported, can be initiated through an email or a phone call and take very little time to establish. Through a network of relationships, program directors and university staff indicated that they connected with potential CTE teachers. Rather than statistics that are collected by agencies like the National Student Clearinghouse, participants in this study indicated that they wanted information that could inform recruitment efforts and post-graduation activities. This information that they desired was reported to be a challenge to access by participants in this study.

Individuals reported relying on networks and relationships because they are not accessing the information they want from existing systems. Formal systems like the database hosted by the U.S. Department of Education (United States Department of Education, n.d.) don’t share data

related to teacher recruitment or retention, resulting in a disjointed structure. Individuals in this study indicated that they wanted more organized, comprehensive data systems that were easily accessible, and they would use more data in recruitment if they had access to it. Systems that shared information would offer a comprehensive way to examine teacher supply and demand, something that Perda (2013) indicated was a challenge because of a lack of comprehensive data. Participants in this study indicated that the data they have access to directly impacts their ability to market their programs to potential students. From this research, it became apparent that with increased access to potential teacher candidate information, recruitment processes could be improved. Chen and Ney (2020) point to promising recruitment strategies that could be implemented to increase program enrollment, if potential candidates could be identified. With stronger recruitment, program enrollment could increase, resulting in an increased supply of teachers entering the CTE pipeline.

Systems that Influence Retention in Teacher Preparation Programs and How They Impact CTE Teacher Supply and Demand

The students who enter teacher preparation programs are another demographic that is important to track throughout their journey to completion. Respondents in this study acknowledged that fewer students completing teacher preparation programs result in a reduced supply of teachers. This reflects the national trend reported by Bishop et al. (2019) of program completion rates in teacher preparation programs decreasing by almost 30% nationwide. Fewer students completing programs results in a reduced supply of teachers, a decline that Bishop et al. (2019) reported is being experienced in every state.

The time when students are in teacher preparation programs is when program directors and others related to the CTE teacher pipeline reported having the most data on their students,

both from formal and informal systems. Because CTE teacher preparation programs are small, respondents indicated, students are accessible. Individuals reported that they know the students because they teach in the program and may serve in an advisory role. During this time, they are connected to the teacher candidates and build the relationships that form a data network which they will rely on in the future, including contact information for ongoing communication and networking. The personal connection between program staff and students serves as the system that allows students to be informally tracked throughout their educational journey.

This research found that at this time in a potential CTE teacher's career, participants considered university data systems as a useful structure to monitor student progression through programs. Universities are interested in retaining students, participants report, and have systems in place to monitor student progress. Some participants in this study indicated that they used or were involved in this data and having information on student progression impacts program completion and increases the supply of teachers in the pipeline. In this portion of teacher preparation, there was more data available to staff than in recruitment and following completers throughout their career. Still, some university participants indicated that they did not have access to or use the data that the university collected on students in their program, citing time to access or search the databases as a barrier.

Systems that Influence Following Completers Throughout Their Career and How They Impact CTE Teacher Supply and Demand

This research found that individuals involved in the CTE pipeline want access to more data on teacher supply and demand. Specifically, individuals indicated that they want information that offers them greater access to individuals who could fill CTE classrooms. They reported that they want to be able to follow program completers when they leave the university.

This research also found that data systems to track completers exist, but what is available is perceived as clunky, outdated, and disjointed. The literature pointed to state systems that don't communicate with one another and are time consuming to use, with Perda (2013) citing a lack of existing data as a barrier to examining teacher turnover. Participants in this research identified a gap in systems that track teachers who leave the state that they are employed in or move between districts as being a barrier to adequately examining teacher supply and demand. As identified in the literature, this lack of comprehensive data also results in an inefficient way to tell if the supply of teachers is too high or too low at any given time (Perda, 2013). Data that tracks teacher preparation program completers could offer insight into teacher supply and demand, but participants in this research indicated that it is a struggle to accurately follow completers in the pipeline. The lack of a comprehensive system to track program completers indicates there is missing information on who is in the pipeline at any given time and prevents accurate monitoring of CTE teacher supply and demand.

There is promising evidence that better data could increase the supply of teachers in the pipeline. Recruitment practices and retention in teacher preparation programs could be strengthened with access to relevant data. The successful components of systems in place could be examined, expanded or replicated to increase the supply of CTE teachers in the pipeline.

Recruitment to Teacher Preparation Programs and Retention in the Profession

This research found that there are components of existing systems which provide relevant information to individuals involved with the CTE teacher pipeline. Replicating the components that were found to be successful could increase the supply of CTE teachers in the pipeline. A successful recruitment model identified in this research is the national TeachAg campaign. This initiative has had success recruiting agricultural education teachers using data that is collected

and submitted by members of the American Association for Agricultural Education (NAAE). The data collected and profiles developed allow for recommendations to be made for programming in the discipline. Participants in this research identified the campaign as a successful strategy to recruit teacher candidates into the profession because of the data that the organization collects and makes readily available.

Strong high school programs were identified in this research as a key place where recruitment into CTE teacher preparation programs happens. Building awareness of the profession was identified by Chen and Ney (2020) as a promising recruitment practice, and this was identified in this research as something that happens in strong high school CTE programs. Strong programs get students excited about CTE content and allow them to build a relationship with a CTE teacher, an individual who is modeling the profession. Individuals in this research who were involved with recruitment indicated that if they had more data on potential students, they would use it. Increasing available accessible data on potential students would result in an increased pool of potential teacher candidates, perhaps capturing students who are not familiar with the training necessary to pursue the career. Training programs for teaching CTE varies greatly, and this may present a barrier to choosing the career pathway (Keily & Perez, 2020). Individuals in this study indicate that they want contact information at high schools, connections to technical colleges, and lists of potential students. With this data, participants report that they could identify students, introduce them to CTE teacher preparation programs, and work to recruit them into the profession more effectively.

A component that participants identified as successful in recruiting teacher candidates to programs and retaining educators in the profession was through relationships and networking. As identified throughout the interviews, participants appreciated the personal connection that they

had with their students and peers and leaned on these relationships to stay connected to the profession. One structure that facilitates these relationships in recruitment are CTSOs. Participants in this study indicated that CTSOs are a powerful recruitment tool with positive outcomes. CTSOs engage students in CTE content and provide experiences on college campuses and facilitate relationships with CTE teachers or advisors. Chen and Ney (2020) suggested that building awareness of the profession may increase CTE teacher recruitment, and participants in this research indicated that CTSO opportunities made students aware of teaching career and technical education as a future career opportunity. Program directors who were involved in student recruitment credited CTSOs as a system for recruiting students to the profession. CTSOs are a potential recruitment system that could be expanded and solidified across CTE disciplines to better connect participants to teacher preparation programs. From this research, CTSOs were identified as a system that resulted in program directors and others involved with recruitment having the data they desired to connect with potential students.

Research indicates that student interest in the profession and enrollment in teacher preparation programs has declined (Aragon, 2016), and program directors and others involved with recruitment in this study indicated that more access to interested students may result in greater opportunities to promote the program to potential students. In addition, completion in teacher preparation programs has declined nationwide by almost 30% (Bishop, 2019), resulting in fewer graduates available to fill open teaching positions. Students leave programs for a variety of reasons, and this research identified opportunities to address retention in programs. With more access to student information, additional supports could be built into programs to mitigate the barriers to completion.

Following Completers Throughout Their Career

After graduation, whether completers choose to enter education directly impacts the supply of qualified teachers in the CTE pipeline. A gap in existing data was discovered in the ACTE Opportunity Fund Region III Teacher Shortage Project (2019), and this study found that there is little information on program completers after they leave universities. Perda (2013) cites a gap in systems that track teachers who move between districts or leave the state in which they are employed as a challenge to monitoring teachers throughout their careers. Individuals involved with the CTE teacher pipeline desire contact information for program completers, this study found. Rather than becoming an educator, some graduates choose a position in business and industry (Zarra, 2019). These individuals make up a pool of qualified teachers who could potentially be recruited back into the profession and increase the supply of CTE teachers. Unfortunately, this study found that tracking program completers once they left the university to be a challenge that resulted in a gap in data on the teacher pipeline. Perda (2013) cited a lack of existing data as a barrier to accurately monitoring teacher supply and demand, and the National Governor's Association (2020) recommended the development of statewide data systems to collect comprehensive labor market information, suggesting that the data would allow for accurate information on teacher supply and demand.

There are formal programs in place such as the Integrated Postsecondary Education Data System (IPEDS) and alumni services. Miller (2019) cited IPEDS as higher-level program data, but participants in this study indicated that it was the student-level data that they were interested in. IPEDS was not mentioned once in the interviews for this research, indicating that the resource is not being used to inform recruitment or retention efforts in the CTE teacher pipeline. Alumni services exist in the universities that study participants interacted with, but participants indicated

that did not access or use data from those systems in a way that adequately connected them with teachers in the CTE pipeline. This gap in data results in a reduced supply of teachers in the pipeline.

Because individuals reported they were not leaning on a formal system to maintain contact with program completers, personal relationships were named as the informal system they relied on for information on teacher supply and demand. During the initial years in the profession, program directors reported that they kept in touch informally with many program completers. One indicated that students in this phase touch back with the university when they are in search of job opportunities that they consider a better alternative. García and Weiss (2019b) found that early-career teachers migrate from districts experiencing high poverty to more affluent districts, and program directors in this study indicated that many recent graduates kept in touch with them when they were in search of a position that they find more attractive or closer to home. However, this connection relies on relationships and the ability to follow up with completers rather than formal, comprehensive data. In addition, it only includes individuals in the pipeline who were traditionally trained and is not encompassing the entire available CTE teacher workforce. With states implementing creative licensing to fill open teaching positions (Devier, 2019), teachers entering the profession through alternative pathways need to be included in the data systems that are available to track teacher supply and demand.

Some individuals in the research indicated that they did not have contact with students after they leave the university, meaning some graduates in the system are not connected to these networks in any way. With research indicating that at the onset of their career, teachers make less money than similar-degreed counterparts, individuals taking a starting position outside of education is a reality (Allegretto & Mishel, 2016). These individuals reduce the supply of

teachers in the pipeline and were identified in this research as a group that is then nearly impossible to locate or recruit back into teaching once they have left the profession. With more data on where completers go when they leave university programs, these individuals could be identified and met with tailored supports to build capacity and retain them in the pipeline.

Conclusions

CTE provides a pathway from education to the workforce. With demonstrated benefits for learners, CTE coursework provides the knowledge and skills that serve as a foundation for future education and employability. Filling classrooms with prepared and effective staff is a component of high-quality CTE programs (Hyslop & Imperatore, 2018). A CTE teacher supply and demand issue has been identified in ACTE Region III, and examining the issue is a challenge because of a lack of a comprehensive data on the pipeline. This research examined the systems and structures that exist for data collection related to CTE teacher education in ACTE Region III as well as the ways that data sources and systems are used to address the issue of teacher supply and demand. Three key takeaways came from this research. First, formal data systems exist but are insufficient in effectively examining the CTE teacher pipeline. The second takeaway is that individuals involved with the CTE teacher pipeline are leaning on personal relationships and networks to find the data that they desire. And finally, this research found that with access to more comprehensive data, informed efforts could be implemented to impact CTE teacher supply and demand.

Through this research it became apparent that formal data systems exist, but the systems are insufficient in supplying the information that individuals desire to address CTE teacher supply and demand. The ACTE Region III Opportunity Fund (2019) found data collection to be a challenge because of the lack of information available on the topic, and participants in this

study confirmed that finding. Because of their inability to acquire desired information from formal systems, individuals related to the CTE teacher pipeline are going other places to find the data. State departments and universities collect student data, but the participants in this study considered the systems frustrating to use or the information available insufficient for their needs. Participants indicated that they did not have time to dig for the data that they perceived was buried in these systems. Aside from citing the systems as outdated and clunky, participants indicated that they do not share information, resulting in a gap in data. This gap in data results in an insufficient ability to analyze the teacher pipeline or address issues with supply and demand.

Participants in this study indicated that they rely heavily on personal relationships within the discipline to recruit, retain and track program completers in the CTE teacher pipeline. Individuals involved in CTE teacher recruitment and retention use personal connections within the discipline to gather data on the teacher pipeline. Program directors reported that relationships with alumni are a strong recruitment tool because it is through these relationships that they have a connection to interested students and CTSO participants. Because of the smaller size of many CTE programs, program directors build strong relationships with students, a network that allows individuals to stay connected in the future. These relationships facilitate future connections in the field, such as student referrals, practicum teacher placements and information about open teaching positions in the field. Relationships are also built through CTSOs. CTSO participants have knowledge of CTE topics and are an identified group of already-interested students who may be targeted for recruitment into the program. CTSO activities foster connections between high school and university staff and engage students in events on college campuses, further building connections within the discipline. Educators also rely heavily on professional organizations and the networking that happens at the events they host to establish and maintain a

personal network within the discipline. Individuals lean on these organizations for data on the teacher pipeline, gathering information on open positions and teacher attrition. This informal system allows individuals the ability to seek out the data they desire through personal connections and relationships. Although these personal networks are a source of information, individuals reported a desire for more data related to the teacher pipeline.

What these takeaways indicated was a demand for more data. Participants indicated that contact information for teachers in the pipeline would allow them to better recruit potential educators into the profession. This is being collected informally, but a more comprehensive system that worked across states and license types would improve the ability to recruit into programs and retain teachers in the pipeline. With this data, efforts could better impact the CTE teacher pipeline. Recruitment and retention could be improved by implementing targeted strategies at critical points in a teacher's career. The Teacher Career Cycle Model is a framework that could inform these efforts if data allowed individuals to be identified within the system. There are promising practices such as TeachAg that have been identified to recruit teachers into programs, retain them in teacher preparation programs, and to follow completers throughout their career. But if these individuals cannot be located because there is no data on where they are, the best practices cannot be implemented and the opportunity to increase the CTE teacher supply is missed. This study found that there are specific stages in an educator's career where they are at a greater risk of leaving the profession. Implementing strategic efforts during these critical points may retain them in the pipeline, and data is needed to identify them at those critical points

Recommendations

Individuals who are linked to the CTE teacher pipeline have indicated that formal data systems exist, but they are insufficient in providing the information on the CTE teacher pipeline

that participants desire. Because of this, individuals indicated that they rely on personal relationships and networks to obtain information to recruit teacher candidates, retain students in programs and follow program completers throughout their career. While they appreciate these personal relationships within the discipline, they desire more data to inform their practices related to teacher supply and demand. A framework for determining the data that would be beneficial in the various stages of an educator's career could provide the information that would allow for targeted strategies to be implemented to recruit and retain teachers. To better meet the demand for high-quality CTE teachers, the researcher makes the following recommendations:

Comprehensive Data Systems

Throughout the interviews, participants indicated that the systems they had access to or used did not share data across platforms. One concern identified in this research was that states collected and maintained their own data, but that it was not shared across states. The systems where data can be found do not offer the information that participants find useful in relationship to the CTE teacher pipeline, this study found. States and universities have data systems, the Department of Labor maintains data, and there are independent data systems in place. However, this study found that participants do not find the information comprehensive or useful. Rather, they desire a system that can follow students as they are recruited into teacher education, retained in university programs and move into their professional life after graduation.

The National Governor's Association (2020) has called for a "transparent governance structure" to "facilitate data sharing, access, and ultimately, track individual mobility from education through the workforce over time" (para. 3). However, barriers at the state level are preventing this from being implemented. One participant indicated that the state's inability to track individuals using social security numbers results in lacking data on the teacher pipeline.

The Education Commission of the States (2020) identifies eight states who offer full reciprocity of teacher licensing and many others who differentiate requirements to move from state to state. Because of this mobility, teachers can be hard to track throughout their career. And program completers who are not teaching are not staying connected with school and professional development networks. This research found that program completers who do not stay in the profession become almost nonexistent in the CTE teacher pipeline.

Midwest states should look to other states who are exploring shared data systems to address this issue. By examining ways that data systems could work together, improvements to data collection and access to information could be made. Having this data available would allow for the CTE teacher pipeline to be examined in a more comprehensive manner and could offer broader implications across other educational disciplines as well. The National Governors' Association (2021) has recommended the development of nationwide systems that bridge education and employment, leaning on state data systems to collect comprehensive labor market information. Some states are piloting programs, and the components of these systems that are found successful could be broadly replicated. Reviewing the Florida Education and Training Placement Information Program (FETPIP) model (Florida Department of Education, 2020) and other state pilot systems may lead to the development of a framework that aligns with the recommendations from the National Governor's Association.

In addition to having comprehensive systems, it is imperative that individuals tied to the CTE teacher pipeline have access to this data and are trained on how to access it. Individuals in this research indicated that they either did not have access to the data they desired or that the time it would take to access it was a burden in addition to the rest of their duties. Because of this,

data needs to be easily accessible and users need to be trained on how to successfully navigate the system to gather the data they desire.

Data Collection Model for All CTE Disciplines

Participants in this study indicated that professional organizations were a system that is successful in retaining teachers. Professional development and the networking that takes place at these events was identified as a system that educators find supportive. These organizations allow individuals the opportunity to connect with peers, access professional development, and achieve leadership positions**.** These activities are highly valuable and improve capacity (García & Weiss, 2019b), and were identified in this study as a way that professionals stayed connected throughout their career. Recognizing professional organizations are a resource for professional learning, it is critical for educators in the pipeline to be connected to these organizations. Providing just-in-time professional development and networking may be a crucial factor in retaining teachers in the CTE teacher pipeline, and professional organizations have the capacity to offer these opportunities. As research indicates, underprepared teachers are more likely to leave teaching positions (García & Weiss, 2019b), and data on the teacher pipeline would allow the best candidates to be targeted for appropriate training opportunities and networking through professional organizations.

The TeachAg structure could be replicated across other CTE disciplines to provide data and inform the pipeline, and the role of professional organizations in data collection should be further considered. The TeachAg model has been successful in recruiting teacher candidates to consider Agricultural Education as a career. A strength of the program is that it relies heavily on data which is collected annually by members of the American Association for Agricultural Educators (AAAE) in cooperation with the campaign and the National FFA Organization. The

campaign also includes powerful, positive messaging about the profession, something that was identified in this research as an area of need in the discipline.

Knowing that individuals in the educational profession are busy, staffing is tight, and that available information is not being used demands additional attention. An organization or institution needs to be identified to be this data clearinghouse and provide the information that individuals desire to inform the CTE teacher pipeline. Having one comprehensive system would allow individuals to quickly pull up relevant data that could inform efforts in teacher supply and demand. The role of professional organizations in data collection on the teacher pipeline should be examined to explore their capacity to assist with recruitment and retention.

Teacher Career Cycle Model as a Training Model

Using the Teacher Career Cycle Model in conjunction with data would allow for targeted strategies and interventions to be implemented at critical points in an educator's career. If an educator is in a phase of their career where they are at risk of leaving the profession, evidence-based practices could be implemented to increase their skills, abilities and efforts. These practices may lead to increased workplace outcomes and increased job satisfaction and ultimately may retain teachers in the pipeline and increase the supply of CTE teachers to fill classrooms.

With effective systems to track program completers, intentional training and intervention could be offered to teachers who are at critical points in their teaching career, as outlined in the Teacher Career Cycle Model. For example, targeted efforts such as mentoring early-career educators may encourage retention in the profession (Zarra, 2019) at a time when educators are at an increased risk of leaving, increasing the available teachers in the pipeline (García & Weiss, 2019b). Carver-Thomas et al. (2016) found that only one third of teachers who leave the

profession are likely to return. Concrete, reliable information on the teacher pipeline would allow for these individuals to be located and potentially recruited back into the profession.

At one or more points in their career, many teachers experience frustration or burnout with the profession. This disillusionment puts teachers at great risk of leaving the profession (Maskit, & Zysberg, 2017) but the risk may be mitigated by collaborating with like-minded professionals who share similar goals (Darling-Hammond et al., 2016). From this research, it became evident that professional organizations are a key place where educators connect to one another and a system where collaboration takes place. Connections to professional organizations during times of burnout may lead to less career frustration and greater job satisfaction, retaining teachers in the pipeline and building the supply of CTE educators through periods of career frustration.

Although many professionals leave teaching for retirement after a long and rich career, others wind down far sooner. In both instances, these individuals are increasing the demand for teachers to fill positions in the pipeline. One strategy that districts are employing is to recruit retired educators back into the profession to fill open positions (Education Commission of the States [ECS], 2018), and the educators' perceptions on the profession may influence their decision to return to the classroom after formal retirement. With comprehensive data on the teacher pipeline, it would be possible to reach this pool of potential educators. If they could be identified, efforts and incentives to retain or pull these senior teachers back into classrooms could be implemented, even to fill a gap for a short period of time.

Identify a Lead Organization for Data Collection

A challenge is determining which group or organization has the capacity to take on this kind of data collection effort. This research has demonstrated a great demand for data from

individuals involved in teacher recruitment, retention in programs, and following completers throughout their careers. Individuals in the study indicate a strong desire for data that they are currently not accessing. Identifying a lead organization who could champion this project would allow for the development of strong data systems that could provide individuals related to CTE teacher supply and demand would have access to.

Further Research

Teacher supply and demand is a topic that demands further research and examination. Throughout this project, the researcher identified several areas where further examination could offer insight into the issue of CTE teacher supply and demand. The areas of further research include the following:

- From this research, it was reported by participants that CTSOs are a key factor in recruiting students into CTE teacher preparation programs. A comparative study among CTSO high school students to examine data to inform recruitment may offer insight into best practices in data collection and use.
- Professional organizations serve as a critical network for CTE educators. A study on the perceived of professional organizations in relationship to their stage in Teacher Career Cycle Model would allow for targeted initiatives to engage educators to be planned and implemented.
- A study on educators' perceptions of access to available data systems would allow for a better understanding of the systems that would benefit individuals with additional training.

- Further research to discover characteristics of systems that are successful in tracking program completers may offer insight on the times in an educator's career where targeted interventions and support could retain them in the profession.

The CTE teacher pipeline is a broad and multi-faceted issue. Data is just one area of focus amid a series of challenges. Across the interviews, a variety of topics emerged that impact teacher supply and demand. Data alone will not solve the teacher pipeline problem, but increasing access to information may offer insight into the issue. Because comprehensive data is needed to inform supply and demand, it needs to be part of the conversation. With better access to complete and accurate data, individuals related to the CTE teacher pipeline could more strategically plan for recruitment into preparation programs, retain students in the programs, and follow completers throughout their career. These efforts would inform the pipeline and could make a difference in teacher supply in demand, both in the Midwest and across the nation.

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Appendix A

Interview Questions

University program staff were asked the following questions:

- Can you tell me about your role? How is your role related to CTE teacher preparation programs?
- Describe the processes in place for recruiting students to your program. How are those recruitment efforts documented?
- What kinds of data sources do use to recruit students to your program?
- How do you monitor retention of students throughout the program?
- Is there a system in place to track more than enrollment and retention numbers in your programs?
- How do you track completers in your program? What systems are in place to track the teacher candidates in your program/department?
- What systems are in place to track completers after graduation?
    - Do you follow up to see if students obtained a teaching license after graduation?
    - Is there a data source that you use to follow completers through their career?
- Do you interact with any systems that are related to teacher retention? Any structures that would track individuals or provide data as teachers engage with your program/department?
- Are you exploring or piloting and data tracking systems to follow students into the workforce? If so, please explain the model that you are examining.

- What additional data or data systems would be useful in recruiting and retaining teacher candidates in your program? (In a perfect world, what would exist for a data system)

State licensing staff were asked the following questions:

- Can you tell me about your role? How does your role intersect with CTE teacher education programs in the state? Is your role related to teacher retention? If yes, can you tell me more about that relationship?
- Identify the ways that a teacher candidate could obtain a teaching license in your state.
- What sorts of data does your state have in place to inform CTE teacher recruitment?
- Outline the process that is used to track teachers after they obtain a teaching license?
    - Do you do any follow-up with individuals who do not renew a license in your state?
- How do you use the data that you collect to address the teacher pipeline?
    - What data sources are accessible by teacher preparation programs?
    - What data do you request from teacher preparation programs?
        - How is that data used to inform program completion and certification?
        - How is that data used to inform retention of teachers?
- Are you aware of the ways that individuals use the data that you collect?
    - Is the data you collect publicly accessible?
- What additional data or data systems would be useful in recruiting and retaining teacher candidates in your program?

Appendix B

Invitation to Participate

Dear _____

You are invited to participate in a study of the Factors Impacting the Career and Technical Education Pipeline in Midwest States. I am conducting this research in Wisconsin and Illinois to examine the systems and structures that are in place to track teacher recruitment and retention. I hope to learn more about the systems that are being used to recruit and retain teachers in ACTE Region III, which is comprised of Illinois, Indiana, Iowa, Minnesota, Missouri and Wisconsin. For the sake of this project, the researcher is focusing on Illinois and Wisconsin for data collection.

You were selected as a possible participant in this study because of your relationship to a CTE program in this region. If you decide to participate, please respond to this email indicating your consent. The researcher will contact you to arrange a time to conduct the interview. The interview is designed to examine the systems and structures in place to track the teacher pipeline. I am asking for an interview that will take about 45 minutes of your time.

No benefits accrue to you for answering the survey, but your responses will be compiled with others to better understand the CTE teacher pipeline in ACTE Region III. Any discomfort or inconvenience to you derives only from the amount of time taken to complete the survey. Any information that is obtained in connection with this study and that can be identified with you will remain confidential and will not be disclosed. Your decision whether or not to participate will not affect your future relationships with myself or the University of Wisconsin-Stout. If you decide to participate, you are free to discontinue participation at any time.

Please feel free to ask questions regarding this study. You may contact me later if you have additional questions by email at feuerhelmk@uwstout.edu or by phone at 612-232-6983. Any questions about your rights may be directed to (name) Chair of the MSUM Institutional Review Board.

Thank you for considering participating in this opportunity and I look forward to your response.

Sincerely,

Katie Feuerhelm