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Experiences of Recent Nebraska STEM Teachers Who Have Left Teaching

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Abstract

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Teacher shortages in STEM (Science, Technology, Engineering, and Mathematics) fields have long been a concern, yet contemporary challenges present a unique predicament. Despite historical recruitment successes, the persistence of this issue has led to temporary solutions that often fall short of addressing the root causes. Consequently, school districts resort to hiring individuals lacking proper certification or expertise, or relying on substitutes, to fill crucial STEM teaching positions. Student academic achievements can be impacted as effective STEM instruction demands not only a deep understanding of the subject matter content but also robust pedagogical practices. To shed light on the complexities surrounding teacher attrition in STEM education, this study employs a multiple-case study approach. Through coding semi-structured interviews, the experiences and perspectives of former STEM educators are examined, providing insights into the factors influencing their departure. By delineating these factors at the individual, local, and state levels, this research contributes to a nuanced understanding of STEM teacher attrition and offers implications for policy and practice.

Dedication

In Memory of My Mom

Brenda L. Sandberg

She had a love for words, thinking outside the box, and creating things of beauty for others to enjoy. She tirelessly encouraged me in all walks of life. She demonstrated the joy that comes from helping children, making me realize my love for young people early in my life.

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To my husband for demonstrating the importance of chasing dreams. He set the standard that if we want our children to excel to their greatest potential, we must expect the same out of ourselves. Thank you for dutifully taking on all the household tasks, with never a complaint, so I could focus on school and family.

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To my friends for standing by me through all stages of life. I have been truly blessed by your deep commitment to me, my family, and my future.

To my amazing teachers for the lessons that I have carried with me decades later.

To my former students who will always hold a special place in heart.

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Chapter 1

Introduction

Teacher shortages are a persistent and prevalent issue across the nation. States are reporting that there are not enough highly qualified teachers to fill vacancies. This means the narrowing margins between vacant positions and the number of applications, providing local schools with fewer options on who to hire (Ingersoll & Perda, 2010). In high-need areas such as science, technology, engineering, and mathematics (STEM), special education (SPED), and foreign languages, the applicant pool is nearly nonexistent in hard-to-staff schools (Goldhaber and Theobald, 2022b). Local school districts are forced to hire teachers who are not certified in the content area or those with provisional certificates (Ingersoll & Perda, 2010). This is worrisome because classrooms of students taught by underqualified teachers have a direct impact on student academic achievements (Clotfelter et al., 2010).

According to Dee and Goldhaber (2017), there are enough teachers to fill all vacancies between university systems graduating teacher candidates and the number of certified teachers registered in state databases. So, what is happening? State-registered, certified teachers are not in the classroom because they have left the profession before retirement age. Sutcher et al. (2019) explain that if local districts can retain highly qualified staff, then concerns surrounding the teacher pipeline would be greatly reduced. The teacher pipeline refers to the pathway or process through which individuals become qualified teachers, including recruitment, preparation, certification, and retention within the teaching profession. This study will investigate the influences contributing to teacher

attrition in Nebraska at the national, state, local, and individual levels through teacher voice.

Context, Background, and Conceptual Framework

STEM teacher attrition remains a critical issue, with many educators leaving the profession due to various challenges. Understanding the factors contributing to this attrition is essential for addressing the ongoing shortage of qualified STEM teachers and ensuring the quality of education in these fields.

Context

There is a need to research which conditions can strengthen or weaken the teacher pipeline. Nebraska citizens do not want just warm bodies in classrooms, they want highly qualified teachers. Investigating state-specific data about what influences are causing teachers to leave the field will allow for the implementation of policies and practices to improve conditions in the field of education, thereby increasing retention rates of teachers.

STEM Teacher Attrition. Research indicates experienced teachers are exiting the field in greater numbers than new teachers are entering the profession. Over the years, the margins between the supply and demand of mathematics and science teachers have been decreasing because of lower supply (Ingersoll & Perda, 2010). Conventional recruitment efforts over the last decade have increased the teacher pipeline in math and science; however, local districts still claim they need help to fill these positions more than English and history jobs (Dee & Goldhaber, 2017). This is because the defects in the teacher pipeline cannot be corrected with an increased flow of recruiting new teachers

into the field. On average, 16% of teachers leave the classroom each year (Goldhaber & Cowan, 2014). Teacher migration and attrition account for an outflow of roughly one-third of math and science teacher positions each year (Ingersoll & Perda, 2010). Teacher turnover is creating pockets of vacancies for building administrators to fill.

Local districts must compete in a lean job market for highly qualified STEM teachers where there are growing numbers of inexperienced and underqualified novice teachers (Ingersoll, 2011). According to American College Testing (ACT) statistics, not only is there a steady decline in high schoolers expressing interest in the field of education but students considering a career in education are lower-than-average achievers on the ACT (Gewertz, 2016). This only heightens the need to retain experienced teachers. When local districts reduce attrition rates, schools can develop new hires adequately because expert teachers can convey historical and pedagogical knowledge onto the new staff. Retaining highly specialized staff creates a ripple effect because hired staff can be properly on-boarded creating a positive experience for new teachers, which is essential in combating early attrition in the first 3-5 years of a teacher's career. If there is consistent turnover happening in mathematics and science departments, causing a decrease in median years of experiences, no one can impart historically successful instructional practices to new staff creating a cycle of frustration, dissatisfaction, and ultimately turnover in STEM.

Researchers agree that the sustainability of the teacher pipeline relies on retaining teachers currently in the field (Whitfield et al., 2021). The biggest issue with STEM teacher supply and demand is that math and science teachers are more likely to leave the field before retirement age (Ingersoll, 2011). Dee and Goldhaber (2017) investigated the

national teacher labor market to identify trends in the teacher pipeline. There is a direct correlation between the strength of the national economy and local districts' challenges in hiring educators. The teacher vacancy rates are highest during times of economic growth when there is a robust labor market and STEM teacher skills are the most competitive (Goldhaber and Theobald, 2022b). If districts can address teacher attrition rates by reducing persistent vacancies in STEM, especially in hard-to-staff buildings, students will be the first to benefit.

A Need for High-Quality STEM Teachers. Sutcher et al.'s (2019) national study on STEM teacher supply and demand finds that 47 states have a shortage of mathematics teachers while 43 States report shortages of science teachers. However, the teacher pipeline extends beyond filling vacant positions, the issue lies in getting qualified educators to instruct students, because currently districts are hiring substitutes, non-certified teachers, and alternatively certified teachers to fill vacancies (Darling-Hammond & Podolsky, 2019). Kersaint et al. (2007) find that alternative certification routes have significantly higher turnover rates than traditional teacher certification programs, further perpetuating the problem. And alternative certification programs have teacher candidates spending less time in the classroom and have no pedagogical preparation leaving these teachers under-prepared (Kersaint et al., 2007). An Australian Council of Deans of Science (ACDS) study revealed that three-fourths of science teachers in Australia are only "suitably qualified" teachers (Harris & Farrell, 2007). This ACDS research found that more than 40% of physics classes are being taught by teachers who took minimal physics courses in college and did not major in physics. When job postings have no qualified candidates, it forces schools to fill positions with underqualified teachers

(Harris & Farrell, 2007). This means the subjects with the highest need for pedagogical knowledge to effectively instruct students are having organizational systems disintegrating due to teacher attrition, which is disrupting programming and decreasing educational experiences for students (Sass et al., 2012).

Being an effective STEM educator is more than having content knowledge. According to Shulman (1986), pedagogical content knowledge is a key attribute in STEM teachers for increasing students' comprehension. Strong content knowledge expands beyond the memorization of facts, rules, and equations. Novice teachers need to comprehend the bigger story behind the formulas and fact patterns. This level of understanding is demonstrated when a teacher understands the justification behind the system at play and can differentiate topics that are central to ones that are peripheral in STEM practices (Loewenberg Ball et al., 2008). A STEM teacher must relay complex concepts to students by producing analogies, explanations, and demonstrations of topics (Shulman, 1986). Understanding both content knowledge and how students learn can impact whether complex concepts are easy or difficult for students to conceptualize. A teacher must not only conduct STEM-specific tasks with minimal error but also quickly locate errors in students' work to identify the proper solution to correct the problem (Loewenberg Ball et al., 2008). Expert STEM educators must rapidly conduct an error analysis on a student's work quickly to identify and respond to underlying student misconceptions. The development of these highly effective STEM units requires purposeful reflection and collaboration with colleagues in a department. STEM teacher attrition does not just result in a vacant position but also a loss of historical practices, lesson planning methods, and pedagogy for effective instruction (Garza et al., 2013).

Impact on Student Learning. As experienced STEM teachers leave the classroom, they are not only creating a vacancy but impacting high school students' career paths. Teachers are the most important variable in increasing student academic achievement (Henry et al., 2012). Palermo et al. (2022) explains that when students have challenging and enriching experiences in advanced science and mathematics classes, they are more likely to pursue careers in STEM. Research conducted by Clotfelter et al. (2010) indicates a correlation between a teacher's disciplinary background knowledge and students' academic achievement within science courses. One of the largest predictors of a student's success in a STEM class is if the teacher is certified in the subject area being taught (Gray et al., 2016). With STEM teacher vacancies on the rise, buildings are filling positions without out-of-field teachers. The average years of teacher experience is low for introductory classes in STEM fields, such as Biology. The trend of decreasing years of experience depicts an increasing rate of teacher turnover in foundational STEM courses can impact student achievement and engagement influencing their long-term decisions to pursue advanced STEM classes (Polizzi et al., 2015).

Henry et al. (2012) differentiated how not all STEM teacher turnover has the same impact on student academic achievement. Students in higher-level mathematics and science courses are more affected by STEM teacher turnover than entry-level students. The classes most influenced by attrition are Physics and Chemistry followed closely by Physical Science, Geometry, and Algebra 2 (Henry et al., 2012). Other studies have confirmed that students do not perform as well with underqualified teachers and are less likely to continue taking advanced classes (Ingersoll & Perda, 2010; Jagla, 2009). This impact creates a domino effect on a student's high school course taking pattern. This

means when schools cannot recruit qualified math and science teachers the effects reach far beyond the walls of a classroom as it impacts the United States being competitive in a global market (Ingersoll & Perda, 2010).

The Cost to Replace. Not only does teacher attrition impact student academic achievements, but it also reduces available funds to districts because there are inherent costs with teacher attrition. With the tightening of state and local budgets, districts cannot waste educational resources to recruit, replace, and train positions due to attrition (Geiger and Pivovarova, 2018). Barnes et al. (2007) calculated Chicago Public Schools recruitment costs to be upwards of $9,500 U.S. dollars per teacher. When teachers exit, districts must not only pay to recruit and hire new staff, but districts also need to onboard new employees with new teacher orientations and additional professional development. These financial costs are most damaging in hard-to-staff districts where student needs are high, resources are low, and financial costs are being funneled into continuously onboarding new staff (Vagi et al., 2019). It is the inequity in how school funds must be dispersed due to staffing concerns that widens the achievement gap for students across the nation (Ingersoll & Perda, 2010).

Background

Over the decades, societal expectations for education have changed the demands placed on teachers. These desired outcomes of society have resulted in federal and state policies, legislation, and regulations on schools. The positive intentions of increasing academic achievements, rigor, and equity across the nation's schools have had unintended outcomes of heavier workloads, less teacher autonomy, and lower prestige in the field. This coupled with a broader and more profitable job market for young people has altered

the sustainability of the teacher pipeline.

Nationwide Pipeline History. Some of the first documented teacher pipeline issues originated from an increase in demand. In the 1980s, the Nation at Risk report indicated that United States students are not competitive with other nations. High school graduation requirements increased in the areas of mathematics and science creating a domino effect of more students taking math and science courses creating an increased demand to hire more teachers (Sutcher et al., 2019). "Math course enrollments grew by 69%, and science course enrollments grew by 60%. In addition, during this period, the number of teacher retirements increased by a striking 141%" (Ingersoll, 2011, p. 38). It is no surprise that the first shortage of math and science teachers was documented in 1987 (Ingersoll & Perda, 2010). Unlike now, the demand for more STEM teachers was met with an influx of increased supply. Ingersoll and Perda (2010) found that the largest growth in highly qualified math and science teachers occurred in the 1990s before No Child Left Behind.

The current wave of teacher shortages came to the forefront in 2015 with over forty states indicating a shortfall in high-need subjects like science, math, and special education (Darling-Hammond & Podolsky, 2019). These shortages occurred in the wake of the Great Recession when budget constraints caused districts to not fill vacant positions and/or lay off teachers. During this time, fewer high school students found education to be a probable field to study. The perception of education has changed in the last decade due to layoffs during the Great Recession, stagnant salaries, and worsening working conditions (Sutcher et al., 2019). In response, President Obama championed an initiative to recruit 10,000 new science and math teachers; however, action plans like

these failed to recognize that the problem does not lie with recruitment, it is found within retention (Ingersoll, 2011). Being a teacher is no longer seen as a prestigious field. From 1993 to 2011, 65% of parents would be happy if their child became a teacher. In 2022, only 37% of parents would desire for their child to become an educator (Kraft & Lyon, 2022). Currently, it is difficult to determine how COVID-19 has impacted students' and parents' perceptions of teaching as a viable career. However, multiple studies have been conducted to compare teacher attrition rates pre, during, and post-COVID-19.

COVID-19 did not create or cause a teacher shortage. Kraft and Lyon (2022) reference a steady and startling decline in the teacher pipeline before COVID-19 and the current politicization happening in education. What COVID-19 did was shed light on a problem that was previously shoved under the rug. There is a disconnect between news and social media surrounding teacher attrition. Newscasts around the nation depicted a mass exodus of teachers leaving the profession following teacher experiences during/after COVID-19. A more accurate story would be an increase in teachers acting on their "intentions" to leave the field. From the forecast of teacher resignation to the actualization of attrition, only about one-third of these teachers left the profession (Goldhaber & Theobald, 2022a). In this same study on teacher attrition rates following the COVID-19 pandemic, there was a decrease in teacher attrition in the 2019-2020 school year marked by an increase in teachers leaving the field in 2020-2021. However, the 2020-2021 teacher attrition rates fall within the normal range of teacher turnover when zooming out and examining data that spans the last thirty years in education (Goldhaber & Theobald, 2022a). Now, teacher mobility did hit an all-time high in the second year following COVID-19, the 2020-2021 school year, with 7.8% of teachers

moving from one school to another. The only years that rival this percentage of mobility are the 1984-1985 school year and the 2006-2007 school years, both having a teacher mobility rate of 7.6% (Goldhaber & Theobald, 2022a, p. 3). Therefore, these results indicate that the teaching profession was struggling with retaining teachers before the pandemic. The teacher turnover following COVID-19 only exacerbated a preexisting condition in education.

Nebraska Pipeline History. These national trends are representative of what is happening in the state of Nebraska. According to Carver-Thomas and Darling-Hammond's (2019) study, the Midwest has the second highest turnover rates in city and suburban districts. There is a shift in attrition trends when looking at rural communities in the Midwest. Rural areas in the Midwest have the second lowest attrition rate at 9.6% in comparison to the highest rates in the South at 14.7% (Carver-Thomas & Darling-Hammond, 2019). The Learning Institute captured Nebraska data in 2016 and 2018 on multiple factors that impact teacher retention and attrition rates. The findings are as follows: teacher attractiveness was 3.55 in 2016 and 3.18 in 2018, the percentage of inexperienced teachers was 12.6% in 2016 and 11.8% in 2018, the percentage of uncertified teachers was 0.2% in 2016 and 0.3% in 2018, and teachers plan to leave teaching 4.2% in 2016 and 7.7% in 2018 (Espinoza et al., 2023). Although Nebraska is below the national average, the data depicts trends of worsening conditions in the state of Nebraska (Stevens, 2023). These findings highlight that math and science teacher shortages cannot be analyzed at a national level because it masks large aspects of what is happening at the state and local levels (Ingersoll, 2011). Each of the fifty states functions as its own labor market with state-specific factors and unique building characteristics that

impact working conditions and influence a teacher's decision to stay (Sutcher et al., 2019).

Conceptual Framework

The conceptual framework for this study was constructed from theories on teacher retention, mobility, and attrition, especially concerning federal, state, local, and individual conditions that impact teacher turnover. Sutcher, Darling-Hammond, and Carver-Thomas's analysis of teacher supply and demand identified multiple factors that are driving teacher turnover in the nation (2019). This study described a variation in teacher shortages based on state, teaching field, type of school, and students (Sutcher et al., 2019). Palermo et al. (2022) created a theoretical framework depicting how science teachers' professional expectations and satisfaction impacted career decisions regarding attrition, retention, and migration by investigating factors related to teacher preparation, student performance, school organizations, and school culture. The conceptual framework of Kraft & Lyon (2022) sheds light on the rise and fall of the teaching profession by measuring public perceptions of the prestige of the profession, career interest, teacher preparation, and job satisfaction. Nguyen et al. (2020) meta-analysis resulted in a conceptual framework that synthesized their empirical research about teacher turnover rates into three interconnected categories: external/policy factors, personal factors, and school factors.

These studies confirm the need to analyze Nebraska-specific data to determine how Nebraska's labor market compares to national studies. This analysis will describe STEM teacher voice as it relates to attrition rates locally and across Nebraska, as seen in Figure 1. STEM Teacher Attrition Conceptual Framework. According to Kraft and Lyon

(2022), Nguyen et al. (2020), Palermo et al. (2022), and Sutcher et al. (2019) studies, teacher attrition occurs due to a combination of factors and not one single variable. The decision-making and ability to change these factors through policies and procedures occur at different levels: national, state, local, and individual. For example, there are policies at the national and state level regarding accountability measures that local districts, schools, and teachers must adhere to. Within the local circle of control, there are factors related to school climate, administrator effectiveness, administrative support, professional development, induction and mentoring practices, collaborative colleagues, and classroom autonomy that can impact teacher retention and attrition rates. The decision-making to change any of these factors happens at the local district or local school level. The individual level of control includes STEM teacher's demographics, qualifications, and career satisfaction. For this study on Nebraska STEM teacher attrition, data was collected and analyzed regarding teacher voice within the individual, local, and state levels of control and their associated factors. When hearing directly from STEM practitioners who have left STEM teaching, it is hypothesized that teacher given reasons will fall within the individual, local, state, and national reasons for leaving. This is further explained in chapter 3, figure 2.

Figure 1

STEM Teacher Attrition Conceptual Framework
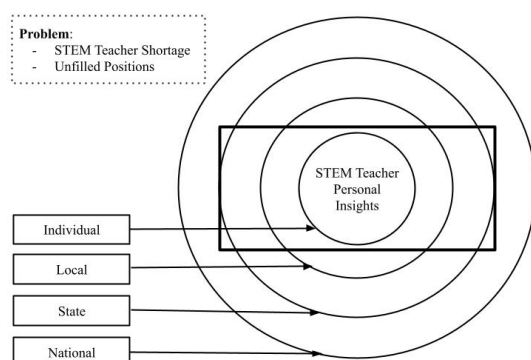
Research Question

- Describe influences that impact Nebraska STEM teacher attrition through the experiences of recent Nebraska STEM teachers who have left teaching.

Operational Definitions

- *Attrition*: The number of teachers who leave the classroom before retirement age (Sass et al., 2012). For this study, STEM teacher attrition includes, but is not limited to, educators who move into administrative roles, university positions, corporate jobs, or stay-at-home.

- *STEM Teacher*: A teacher within the STEM field includes natural sciences, computer and information sciences, engineering, and mathematics (Gonzalez & Kuenzi, 2012). For this study, STEM teacher fields do not include social and behavioral sciences, such as political science, psychology, sociology, or economics.

Purpose

This study will analyze STEM teacher data and voice to identify STEM teacher turnover patterns in Nebraska. The results will contribute to the larger story of the Nebraska teacher pipeline. It will provide academic merit to the field by supplying data to inform school leadership in decision-making regarding policies and procedures. Additionally, it will benefit the field by educating stakeholders on STEM teacher attrition to mitigate conditions that contribute to high turnover rates.

Delimitations

Formal boundaries of the study include only interviewing STEM teachers who have left the profession within the last 5 – 10 years to capture the most recent influences impacting teacher attrition. Each state has its own unique job market, this study will only investigate Nebraska STEM teacher and non-STEM teacher attrition. Regarding participants, a convenient sample will be used for initial interviews because this dissertation's research is first, not final. For this study, technology and engineering content area teachers will not be included. Technology teachers can vary across the state. Depending on the school's need, a technology teacher could take on multiple roles in smaller schools/districts as both the building technology technician and teacher. The researcher will start with science and math teachers because they are more definable positions.

Problem Statement

There is a problem with the supply of highly qualified STEM teachers across the state of Nebraska. Despite recruitment efforts with high school grow-your-own programs, para-to-teacher initiatives, and teacher preparation scholarship programs, school districts across the state still report issues filling vacant STEM positions adequately. The problem has negatively impacted student academic achievements, STEM course-taking patterns in high schools, teacher working conditions, and district budgets. High turnover rates in STEM classes impact teacher effectiveness, instructional practices, and the allocation of district resources. A possible cause of the problem is a combination of national, state, and local school influences.

Summary

To adequately address the teacher pipeline issue, leaders need to look beyond teacher production and recruitment techniques and focus on why there is such a high turnover rate in STEM teachers (Ingersoll & Perda, 2010). When the issue of STEM teacher attrition is addressed, the current teacher pipeline will be able to keep up with the supply and demand. Historically, policymakers have been reactive regarding a lagging supply of teachers. Efforts are focused on increasing the teacher supply without considering that if fewer teachers left the field before retirement there would be no issues with recruitment (Sutcher et al., 2019). To address issues with the teacher pipeline, it is crucial to treat the cause and not the symptoms. It is essential to study the national, state, local, and individual conditions for teacher attrition within the state of Nebraska to better inform workforce needs and improve retention rates through teacher voice (Palermo et al., 2022).

Chapter 2

Literature Review

When analyzing STEM teacher attrition, the multitude of factors that influence a teacher's decision to stay or leave the profession are interconnected in a giant web. When analyzing the problem of attrition, it must be deeply understood. These conditions for attrition do not happen in silos and adjusting one factor has implications for others. These factors have been organized based on where the decision-making lies for imparting change, such as national, state, local, and individual. For example, high stakes testing, and accountability measures of schools are set by national and state policy while leadership aspirations to move up and out of the classroom are made by the individual. Conditions that are fixed and cannot be easily altered; however, can still impact teacher attrition rates are local and individual demographic information. When considering the national, state, local, and individual context, one must look at the problem and consider solutions at all four levels. STEM teacher attrition factors fall into the following buckets: National and State STEM Teacher Conditions, Local Demographics, Local Working Conditions, Individual STEM Teacher Demographics, Individual STEM Teacher Qualifications, and Individual STEM Teacher Career Satisfaction.

National and State STEM Teacher Conditions

National and state educational policy has impacted education reform, public perception of the role of local schools, and individual teacher working conditions. Like a droplet landing in a pool of water, a small splash ripples into a larger wave; federal

education policies function as a catalyst for state and local districts to react and expand control through regulations, policies, and procedures. The federal government establishes broad expectations for public education inviting each state to develop legislation that embodies these initiatives. Local districts inherit these legislative policies and are tasked with creating the road map to actualize the intended outcomes. Over the past century, national and state policies have created a ripple effect in the teacher pipeline.

National Accountability Measures

Research indicates that one of the biggest educational policy waves originated from accountability measures. Accountability measures date back to one-room schoolhouses and the necessity for teachers to have students pass the eighth-grade assessment (Ward & Ward, 2017). A teacher's pass rate determines rehire for the following year. It was not until early in the 20th century that accountability measures compared access to resources and student outcomes. In the 1950s and 1960s, Civil Rights movements shed light on the disparage of equal education across the nation. Citizens demanded policies to end segregation and socioeconomic inequities (Griffen, 2022). Because schools are funded locally, the wealth of a state or community has huge implications on the economic means of a school to educate the youth in the area. Impoverished communities had fewer educational resources than their wealthy counterparts. Throughout the span of a decade, the federal government passed multiple laws responding to the unequal treatment of citizens including the 1965 Elementary and Secondary Education Act (US Department of Education, 2021). The Elementary and Secondary Education Act (ESEA) established a series of checks and balances in the American education system to ensure students have equal access to educational

opportunities through programming like Title I (Riley, 1997). With each reauthorization, the main priority of equality remains the same, the federal government continues to integrate more accountability measures. In 1994, the revised and reauthorized ESEA named Improving America's Schools Act increased educational accountability by making curriculum and assessments aligned to standards (Le Tendre, 1996). In 2002, ESEA was reformed and revised to the No Child Left Behind Act (NCLB) requiring schools to be held accountable for students' academic achievements (Boyd et al., 2008). Schools' ability or inability to demonstrate Adequate Yearly Progress (AYP) in student learning resulted in schools being labeled as failing or School in Need of Improvement (SINI) (Olson, 2018). The SINI designation penalized schools that could not demonstrate academic improvement in students, such as after five years of not meeting AYP a school could be required to replace many of its staff (Sass et al., 2012). Furthermore, NCLB requires states to employ highly qualified educators by requiring a bachelor's degree, state teacher certification, and to demonstrate proficiency in one's subject area (Kraft & Lyon, 2022). In 2015, the ESEA was reauthorized as Every Student Succeeds Act (ESSA) which held schools accountable for making students college and career-ready (Olson, 2018). Although ESSA did roll back some of the NCLB measures, it still required states to evaluate school success, assess students' academic abilities, and hire qualified teachers; however, now states create their own State Plans to address these accountability measures (Griffen, 2022). Now, more than ever, a state's local control over educational practices has resulted in desired and unintended outcomes in schools, impacting the teacher pipeline and creating fifty separate labor markets (Sutcher et al., 2019).

State Accountability Measures

In the wake of national "accountability," outside stakeholders have steadily been influencing state policies and practices to improve teacher effectiveness and boost students' achievement on standardized assessments causing business models to be implemented to increase teacher efficiency (Mehta, 2013). This approach takes the power away from local schools and teachers while placing key decision-making in the hands of individuals removed from the realities of the classroom. No Child Left Behind (NCLB) created a high-stake testing environment in which content area teachers were tasked and evaluated on their ability to increase levels of proficiency in students (Mehta, 2013). Initially, Nebraska attempted to implement NCLB while still maintaining local control with the norm-referenced School-based, Teacher-led Assessment and Reporting System (STARS). Each district had the sovereignty to decide how to measure its standards and outcomes along with its students' progress toward those proficiency standards and outcomes (Dappen & Isernhagen, 2005). The assessment portfolios presented to the Nebraska Department of Education could not be used to compare districts to each other. The goal of STARS was to measure student growth within the district allowing schools and teachers to make informed decisions regarding best instructional practices which gave authority in decision-making to local districts' administrators and teachers (Dappen & Isernhagen, 2005). The United States Department of Education did not approve the STARS assessment for compliance with NCLB spurring Nebraska to create a statewide standardized assessment, the Nebraska State Accountability (NeSA) test, written by Nebraska educators (Olson, 2018). The NeSA and later its successor, the Nebraska

Student-Centered Assessment System (NSCAS), allowed stakeholders to compare districts to each other.

Local Impact of National and State Accountability

The unintended outcome of this type of comparison is the publication of assessment scores allowing local districts and schools to be ranked, which created buckets of best and worst or have and have nots (Harrell et al., 2019). The notion of assessment accountability and teacher effectiveness enacted utopian expectations on teachers without having an idea of how schools should tackle the age-old influence of socioeconomic status, poverty, and minority variables on student learning (Mehta, 2013). The public could misappropriate assessment scores to label educational institutions causing certain local districts and schools to be less desirable than others resulting in issues with staffing (Kraft & Lyon, 2022). According to SASS (School and Staffing Surveys) results, one-fourth of teachers who left the profession cited job dissatisfaction from pressures to increase the standardized assessment scores of low-achieving students (Sutcher et al., 2019). The past continues to repeat itself, from the Coleman Report, A Nation at Risk, No Child Left Behind, Race to the Top, and Every Student Succeeds Act, repeatedly, American schools have been labeled as "at risk" or "failing" which has resulted in outside players coming in and creating systems and assessments to improve schools. These methods do not result in significant improvements, yet they do yield negative perceptions of teachers and schools (Mehta, 2013). The established system is impacting the pipeline of teachers. These rating systems alter teacher autonomy, self-efficiency, and perceptions of effectiveness which impacts job satisfaction increasing teacher attrition rates.

Accountability measures at the national and state levels trickle down and directly impact teachers. According to Brantlinger's (2021) study on leavers, stayers, and movers in mathematics teaching, one reason for teacher attrition is the impact of the state's high-stakes accountability testing. The focus on increasing student pass rates on high-stakes assessments distracts from instructional time and causes teachers to need to cut lessons to ensure there is time for test preparation (Mehta, 2013). This is an issue because highly engaged STEM teachers are motivated and feel a sense of accomplishment when teaching students skills that are necessary to navigate real-life experiences with their content. Rigorous STEM education is about the application of concepts to meet the current demands in society. These opportunities are meaningful and intrinsically motivating to students. However, problem-based learning opportunities are time-consuming and difficult to execute when STEM teachers are expected to allocate large portions of time to preparing and testing students. These findings are consistent with Brantlinger's survey results where 17.5% of teachers stated having dissatisfaction with how accountability testing impacted their autonomy and ability to teach (Brantlinger, 2021, p. 47). Over the decade, this loss of professional autonomy has changed teachers' perceptions of their effectiveness and impacted teacher retention rates (Kraft & Lyons, 2022). These impacts are greatest in hard-to-staff schools. Besides the pressures placed on teachers in underperforming and hard-to-staff buildings to have students pass high-stakes assessments, another unintended outcome is teachers' perceptions of their job security. Kraft and Lyon (2022) studied the steady decline in a teacher's job security citing the largest decline between 2008 - 2012 when states began designing, piloting, and administering high-stakes assessments. This drop in job security has altered teachers'

career aspirations in schools with challenging students, affecting teachers' decisions to stay in the profession until retirement age and creating more vacancies in already hard-to-staff schools.

National Workforce

Over the past century, societal and economic advancements have changed the national landscape of the teacher pipeline. Before the Civil Rights movement, females had limited access to positions in the labor market causing a considerable number of women to pursue careers in teaching and nursing (United States Department of Education Office for Civil Rights, 2012). As women gained greater access to colleges and careers, there has been a slow and steady decline in teacher education graduation rates. Kraft and Lyons (2022) state that 25% of college graduates obtained a teaching degree in the 1970s, this number slipped to 12% by 1987 and continued to fall to its current 8.1% in 2019. This means that districts must compete with one-third of the pool of educators they did five decades ago (Kraft & Lyons, 2022). It is becoming more competitive to recruit and retain highly qualified teachers.

Not only is the teaching workforce a reflection of national and state policies but economic conditions as well. Dee and Goldhaber (2017) studied the American teacher labor market to establish trends in teacher shortages. There is a direct correlation between a strong economy and challenges in hiring educators. Teachers are more likely to stay in the classroom when the labor market is thin and unemployment rates are high (Goldhaber & Theobald, 2022b). This trend is repeatedly seen over time and was most recently observed during and following the COVID-19 pandemic. Although large amounts of teachers cited dissatisfaction and overwhelming workloads, there was a reduction in

attrition rates in the spring of 2020 due to high unemployment rates (Goldhaber & Theobald, 2022a; Kraft & Lyon, 2022). As the economy stabilized and unemployment rates dropped drastically, the number of teacher vacancies increased in 2021 and 2022 (Goldhaber & Theobald, 2022a).

State Workforce

These national trends impact the state's teacher workforce. A teacher vacancy occurs when local school districts have teaching positions that remain unfilled. These shortages result in districts needing to fill openings with long-term substitutes or educators who are not certified in the content area (Baylis-Satcher, 2022). Vacancies occur when new openings are created in a district, such as when some districts allocated federal aid from the COVID-19 pandemic to hire more educators than they had staffed before the pandemic (Greer et al., 2022). The more common cause of vacancies is when an educator voluntarily leaves due to retirement, migrates to a new position within education, temporary certification expires, or vacates the field of education (Kersaint et al., 2007). Most math and science teacher vacancies are not a result of a graying workforce, but rather STEM teachers exiting the profession before retirement age (Ingersoll, 2011).

When analyzing teacher supply and demand, there is an adequate number of state-licensed teachers to meet vacancy demands (Dee & Goldhaber, 2017; Goldhaber & Theobald, 2022a); however, this single data point only tells a part of the story. Not all teachers with a state teaching certificate are in the classroom for various reasons, such as family obligations, positions outside of education, and out-of-state certification (Kersaint et al., 2007). Qualified teachers who have migrated states cannot fill vacancies because

there are numerous roadblocks, such as, state requirements for licensing, previous teacher certifications not passing state lines, and pension packages not transferring across districts (Dee & Goldhaber, 2017). Additionally, many state Teacher Education Programs (TED) indicate that their enrollment and graduation rates are adequate to meet the current demand for teachers, yet these novice teachers are not certified in the areas of highest need, so vacancies remain (Goldhaber & Theobald, 2022a). In the state of Florida, TED programs are only supplying one-fifth of the mathematics teachers necessary to fill the current vacancies (Greer et al., 2022).

The national and state workforce impacts local schools. When districts do not have a sufficient supply of teacher candidates, they must use alternative measures to fill vacancies. Sutcher et al. (2019) report that Arizona schools had 4,000 vacancies in the 2015-2016 school year resulting in local districts hiring staff that did not have the teacher requirements for the content area. In Florida, roughly 6% of secondary mathematics classes are taught by teachers who are not certified in the content area (Greer et al., 2022). Moeller et al. (2018) confirm that there is a national trend in local districts hiring staff that are unqualified or still seeking certification under the guise of "plans of intent" meaning the staff member plans to complete the requirements to be qualified in their content area within a reasonable amount of time. Additionally, more states are issuing emergency teacher certificates to fill vacant positions (Sutcher et al., 2019). When these alternative methods of filling vacancies fall short, local districts are forced to reduce course offerings. In New York City, almost 50% of the schools do not offer physics because they cannot fill the positions due to persistent vacancies and continuous turnover (Ake-Little, 2019).

National and State Vacancies are Unilateral

Vacancies are not common across the board and can vary locally based on geographical region, school, level, and subject area. These determinants of teacher supply and demand can mean that surpluses and shortages are happening at the same time within the teacher pipeline (Ake-Little, 2019; Edwards et al., 2022). The local geographic regions that are the most afflicted with teacher vacancies are rural and urban schools while suburban schools have the least number of vacancies (Dee & Goldhaber, 2017). This means that while certain districts are plagued with vacant positions, other districts within the same region have a reasonable amount of qualified and well-trained applicants for each job opening (Ake-Little, 2019; Darling-Hammond & Podolsky, 2019). When Goldhaber and Theobald (2022a) studied teacher turnover data, trends appeared between schools with the highest attrition rates in the spring and the greatest number of vacancies in the fall. This is because teacher candidates are less inclined to apply for positions in schools with historic turnover issues when other options for employment are available (Sutcher et al., 2019).

Even within one local district, the vacancy rates are different based on level. Secondary schools have exponentially more vacancies than elementary schools resulting in 73% of vacancies happening in secondary schools (Edwards et al., 2022). However, not all content areas in secondary education are experiencing teacher shortages because there is an adequate supply of both English and history teachers (Dee & Goldhaber, 2017). Content-specific vacancies have been well documented since the 1980s with the greatest shortages happening in special education followed by STEM teachers. By 2007, the two highest areas of need flipped having STEM pull ahead with more annual

vacancies (Dee & Goldhaber, 2017). STEM's increased vacancy rate could reflect more STEM class offerings in secondary schools this past decade. Furthermore, the vacancies happening within STEM education are the most prominent in math and science (Dee & Goldhaber, 2017; Ingersoll & Perda, 2010). These positions experience greater turnover due to science and mathematics teachers having credentials that allow them to transition into better-paying jobs outside of education which does not hold true for other content areas (Kersaint et al., 2007).

Bleak National and State Projected Vacancies

In the wake of the pandemic, there is a growing concern that teacher turnover will continue to rise, especially in local schools and content areas that have already had long-standing vacancy issues (Goldhaber & Theobald, 2022b). These fears are rooted in teacher survey results showing increases in individual teacher stress levels and burnout rates causing them to consider leaving the profession (Baylis-Satcher, 2022). Historically speaking, the potential increase in teacher turnover will not likely result in classrooms without a certified teacher because local districts cannot leave classrooms unstaffed (Ingersoll & Perda, 2010). Instead of vacancies, classrooms will be staffed with alternatively certified, non-certified, and emergency licensure teachers. Another option is districts altering working conditions by using teachers' plan time to cover a vacant classroom or increasing classroom sizes. The current solutions to fill vacant positions do not result in employing highly qualified educators and only put a Band-Aid on an issue without exploring the underlying conditions (Lee, 2018; Müller et al., 2009).

Competitive National and State Job Markets

There is a competitive job market happening not only across Nebraska but nationally too. With an increase in remote work options, the national labor market has a larger impact on states than ever before. Teachers are leaving the field of education for improved working conditions. Following the COVID-19 pandemic, more educators are looking for a flexible schedule allowing for a better work-life balance (Dill, 2022). More so, it is particularly difficult to retain mathematics and science teachers because their credentials make them candidates for a broader spectrum of non-teaching jobs, so they have more opportunities to find a position that aligns with their work ideals (Sutcher et al., 2019). A salary increase is not the primary motivating factor for teachers taking private-sector jobs, they are mainly seeking more autonomy and intellectual freedoms (Dill, 2022). Teachers want to have a seat at the table regarding decision-making, be supported when making professional decisions, and be held in high esteem by their bosses and community (Mehta, 2013). Educators want to be valued for their knowledge base and skills which many reports are not currently happening in schools. "The pandemic has shown teachers they have other options and avenues to success, whether they define that as money, fulfillment or professional growth" (Dill, 2022, p. 5).

The move to non-teaching positions has been and continues to be the most common for STEM educators because the requirements for certification to be a mathematics or science teacher are marketable outside of the field of education, making math and science teachers qualified for higher-paying business and industry positions (Kersaint et al., 2007). It is this valued skill set that pulls STEM teachers from the classroom (Nguyen et al., 2020). Credentials aside, companies are seeking the soft skills

that teachers provide. The private sector is recruiting teachers for their ability to respond quickly to situational problems, manage job pressures, and multitask (Dill, 2022). Teachers are being hired frequently by industries that specialize in sales, healthcare training, staff agencies, and instructional coaches. Teachers' capabilities to absorb new knowledge, transmit information effectively, and individualize communication based on the situation are what make teachers a hot commodity for companies (Dill, 2022).

Local Demographics

Staffing issues can happen within the same local community due to differences in school districts or buildings (Ingersoll & Perda, 2010). A local building's demographics play a role in teacher attrition rates.

Local Districts Salary and Benefits

Public schools are primarily funded by local, state, and federal tax formulas; however, how these monies are allocated toward teacher salaries and benefits is dependent on the district's school board and collective bargaining (Edwards et al., 2022). This level of local control allows each district to set its own unique pay scale for teachers based on their level of education and years of experience (Djonko-Moore, 2016). These salary schedules can be one of the largest determinants of recruiting and retaining highly qualified teachers because educators want to be compensated for their expertise (Edwards et al., 2022; Geiger & Pivovarova, 2018; Moeller et al., 2018). The newest generation of teachers joining the workforce is acutely aware of college debt and loans resulting in educators applying in districts with the highest base salary (Moeller et al., 2018). Additionally, districts with salary schedules that do not level off a teacher's earning

potential after a series of years have better retention rates and less turnover (Carver-Thomas & Darling-Hammond, 2019). Districts that invest in their educators by having the highest salary schedules in the region experience the lowest rates of teacher mobility to surrounding districts (Ondrich et al., 2008). Pay scales are not uniformly beneficial since they have negatively impacted the recruitment and retention of STEM teachers. Teachers with degrees in mathematics or science have higher earning potential outside the field of education (Hanushek & Rivkin, 2004). These preset salary and benefit schedules determine the earning potential of a STEM educator and if it is not competitive it can be predictive of teacher attrition (Djonko-Moore, 2016).

Teachers in the United States make 30% less than other college-educated professionals (Darling-Hammond & Podolsky, 2019). This notion of lower earning potential impacts nonvested early career educators more because their lack of years of experience is compounded by a lower salary (Garcia et al., 2022). When a STEM teacher considers leaving the field of education they balance pay, benefits, and working conditions (Hanushek & Rivkin, 2004). In exit surveys, math and science teachers indicated salary levels as a key reason for leaving the field (Brantlinger, 2021; Ingersoll & Perda, 2010). For schools to retain highly qualified STEM teachers, they must offer salaries that are competitive with non-teaching salaries (Ondrich et al., 2008). To increase employee job satisfaction, the employees must feel like they are being adequately and fairly compensated for their work (Sirota et al., 2005). Kraft and Lyons confirm this in their multiple-decade study on the decline of the teaching profession in the 1970s and the rise in the 1980s. Out of all the teaching factors analyzed, the variable that had the largest impact on increasing and stabilizing the teacher pipeline was teacher compensation (Kraft

& Lyons, 2022). Edwards et al. (2022) reinforce the importance of salary in decreasing teacher vacancies; however, they find that no salary increase can outpace the impact of working conditions on teacher turnover.

Salary is not the largest factor impacting teacher job satisfaction. Teachers leaving the field of education ranked insufficient planning time, massive workloads, and student behavior over salary as contributing factors for attrition (Thornton et al., 2008). When analyzing teacher salary, it is important to look past the salary number and decipher what that salary amount implies. A long-standing theme in teacher compensation is that educators do not enter the profession due to the salary. The salary itself is not a primary contributing factor to job satisfaction for a teacher. However, trends in teacher salaries do depict public perception of educators and the level of prestige for the profession (Kraft & Lyon, 2022). Districts suffering from teacher turnover have attempted to increase salaries by a few thousand dollars and the outcome has been statistically insignificant (Djonko-Moore, 2016). Minor salary incentives are not huge motivators in retaining teachers because the primary motivator for teachers is wanting to make an impact on student lives and when working conditions influence their ability to perform then job dissatisfaction remains (Müller et al., 2009). Although teachers leaving the field reference moving to higher paying positions with less stress, Kersaint et al. (2007) highlight that stayers are fine working a lower salary job if they have positive building dynamics. Conversely, teachers will and do leave education for less pay and better working conditions too (Garcia et al., 2022).

Local Schools Type, Location, and Level

Local schools are the lifeblood of a community regardless of the size of the community. Schools play a vital role in a community's sustainability in population growth and prosperity (Moeller et al., 2018). The factors that impact individual STEM teacher recruitment and retention vary based on type and location.

Type of School. There are three main types of local schools for educators to work within: public schools, private schools, and charter schools. Regarding the type of school, charter schools may be able to recruit STEM educators; however, they have the most difficulty retaining teachers long-term (Garcia et al., 2022). When comparing the survival rate of teachers in public schools versus charter schools, charter schoolteachers are twice as likely to leave or migrate than public school teachers (Ndoye et al., 2010). Charter schools may tout increased flexibility and choice for parents and teachers, yet the high hazard for teacher attrition in these schools creates concerns regarding student academic achievement which has direct ties to a consistent learning environment (Sass et al., 2012). As the state of Nebraska considers charter schools, it is essential to not only look at school choice options from the lens of parents and students but also realize that teacher retention rates are not consistent in all types of schools.

Location and Size. Based on location and size, there are rural, urban, and suburban schools within the state. These local schools' function under the same umbrella of national and state conditions; however, their experiences with recruitment and retention vary. The ability to staff STEM vacancies in rural, suburban, and urban districts depends on their access to teacher education colleges, access to equitable working

conditions, access to resources and professional development, and accessibility to needs provided by the external community.

Access to Teacher Education Colleges. The location of a district relative to a university that has a teacher education college, with STEM course offerings, greatly impacts the ability to recruit teachers to the local district. Regarding location, Ingersoll and Perda (2010) found that teacher production is not occurring in locations where the teacher pipeline is the driest. The isolation of rural communities keeps them from having access to the same pool of teacher candidates as the suburban and urban districts, meaning positions may remain vacant for longer periods (Goodpaster et al., 2012). The struggle with supply comes from a teacher's desire to teach relatively close to where they either grew up or went to college causing STEM teachers to stay close to home (Ingersoll & Perda, 2010). If a rural community can overcome the hurdle of recruiting and retaining a teacher past five years of teaching, research indicates that they are likely to finish their career in that same small town, which is a promising statistic that does not hold true in suburban or urban communities (Goodpastor et al., 2012).

Access to Equitable Working Conditions. Both rural and urban schools risk STEM teacher migration to suburban schools that offer higher socioeconomic status and a shift in working conditions (Palermo et al., 2022). Urban schools are at the greatest risk of teacher attrition because these teachers are seeking more job satisfaction (Ingersoll, 2011) in comparison to rural schools with relatively lower attrition rates related to workload concerns. Oftentimes, the solution to vacancies in rural and urban STEM classrooms is to have non-certified teachers fill these positions. Rural STEM education especially suffers when these teachers feel underprepared and inadequately supported to

teach these out-of-certification areas because they may be teaching many of the science course offerings in the school (Goodpaster et al., 2012). When surveyed, rural STEM educators indicated that higher salaries would be a motivator to recruit and retain STEM-certified educators because of the level of expertise they must have to teach a multitude of highly specialized, content-rich science class offerings at the secondary level (Goodpaster et al., 2012). These teachers stated the additional workload of teaching multiple preparations and playing numerous roles within the rural school community should equate to higher wages and benefits. Not all researchers agree with the rural teachers' stance. Dee and Goldhaber (2017) state that the solution to increasing teachers in rural and urban high-need locations is not as simple as providing these content areas with higher compensations than their elementary and secondary counterparts. The solution of salary will do little to fix the issue because the pipeline problem in rural communities is rooted in its location to STEM teacher supply and the issue in urban communities is job satisfaction.

Access to Resources and Professional Development. STEM teachers in rural communities must meet the needs of various learners with fewer resources. Local rural communities house industries like meatpacking plants which employ workers who are often immigrants and transient. Teachers in these communities are tasked with educating high-poverty students with large pockets of English language learners while receiving fewer support and resources than in larger suburban and urban districts (Moeller et al., 2018).

Another type of resource available to teachers in rural, suburban, and urban districts is professional development. Larger districts located in suburban and urban

regions have established professional development departments while rural districts rely on regional educational service units for similar services (Darling-Hammond et al., 2017). Although rural teacher professional development varies from larger districts, there are still opportunities available for rural teachers. Some grants are specifically for sending rural teachers to trainings and workshops (Goodpaster et al., 2012). Outside of the larger professional development infrastructure, rural and suburban educators may function as a department of one in their building, so they do not have a large pool of STEM educators to collaborate and grow with (Goodpaster et al., 2012; Brantlinger, 2021; Darling-Hammond et al., 2017). However, a benefit of a rural STEM teacher is more autonomy in curricular decision-making and increased local business engagement in schools. The interdependence between the school and business community means teachers have access to support from knowledgeable STEM experts in the community. A strength of rural communities is access to opportunities to bring STEM to life through wind turbines farms and nitrogen lessons with farming making real-world applications easy for teachers (Goodpaster et al., 2012). These factors increase STEM teacher job satisfaction in rural communities.

Accessibility of the external community. The size and support available in a local community impact a teacher's decision to live and work in a rural, suburban, or urban city. When determining where to lay down professional roots, educators consider not only the local school's available resources but also the community at large. Young teachers want to live and work in a community that offers places for social gatherings like restaurants, bars, and numerous entertainment options. Teachers with families are looking for a local community that has access to reliable childcare, adequate housing

options, and medical care. The pipeline is driest in smaller towns than in urban communities due to teachers citing isolation from a lack of community amenities (Moeller et al., 2018). Additionally, assimilating to the community is a large part of teaching within a rural community. There is an interconnectedness between teachers' lives in and outside of work. When teachers struggle to develop positive social networks, they are more likely to leave their teaching position within the community (Goodpaster et al., 2012). Adversely, the drawback of an active rural community life is the fluid boundaries that happen between school and personal life increasing the need for interpersonal relations to add to one's reputation formation and diminish damage to their character (Goodpaster et al., 2012).

Elementary vs. Secondary Level. Teacher attrition rates vary based on the level of the school. Elementary teachers are less likely to leave the field of education than secondary teachers. Furthermore, elementary and secondary educators leave the classroom for different reasons. Elementary school teachers are more likely to leave low-performing schools while secondary teacher attrition rates are greater in high-performing schools (Sass et al., 2012). One theory Sass et al. (2012) offers is that elementary teachers are leaving for better working conditions while secondary STEM teachers are migrating from high-performing schools to take higher-paying positions at the district level or outside of education.

Title I, Poverty Rates, and Free and Reduced Lunch Programs

Teacher retention rates are impacted by school demographics. Teachers are more likely to stay in schools with lower proportions of minority students, higher student attendance, and fewer student behaviors (Grant & Brantlinger, 2022). Teachers who have

the highest percentage of disadvantaged students are the most likely to experience attrition (Ondrich et al., 2008). Specifically, physics teacher attrition and mobility are higher in schools where half or more of the population receive free or reduced lunch (Palermo et al., 2022). High-poverty schools account for one-fourth of the public school system, yet they account for over fifty percent of teacher attrition (Ingersoll, 2011). Carvas-Thomas and Darling-Hammond's (2019) study found that "mathematics and science teacher turnover rates are nearly 70% greater in Title I schools than in non-Title I schools (18% vs. 11%, $p <0.01$) … teachers with more experience have turnover rates nearly 80% higher in Title I schools than in non-Title I schools (9% vs. 16%, $p <0.01$)" (p. 8). Of these math and science teachers who are migrating, they are moving to suburban schools with lower minority rates and less poverty (Ingersoll, 2011). With high rates of teacher turnover, high-poverty schools with inequitable funding do not have the resources to continuously hire, to adequately train, and to offer competitive salaries to educators resulting in underqualified and inexperienced teachers staffing these schools (Sutcher et al., 2019). This issue is magnified by the fact that high turnover, with limited applicants, results in schools hiring teachers without conventional certification in the highest-need subject areas like STEM (Dee & Goldhaber, 2017). Inexperienced and underqualified staff only perpetuates the high rates of teacher turnover in STEM education.

School administrators and policymakers like to point the finger at low-income schools saying poverty is the cause for high attrition rates; however, this is not the culprit. It is dangerous to do a reverse causality between poverty ratings and teacher turnover rates because it is ripe with selection bias (Nguyen et al., 2020). When researchers

broaden the lens focused on high-poverty schools there are other reasons impacting

attrition rates (Geiger & Pivovarova, 2018; Harrell et al., 2019; Ingersoll, 2011; Johnson

et al., 2012; Nguyen et al., 2020). Geiger & Pivovarova's (2018) research found that

when high-needs schools have strong leadership, established support systems, and access

to resources there is not a statistically significant difference in attrition rates. Johnson et

al. (2012) investigated working conditions in high-needs schools and the impact on

teacher career decisions. Their findings suggest that the working conditions in high-needs

schools are what influences teacher attrition rates, not the student demographics. The

high rates of math and science teacher turnover in disadvantaged schools are a product of

student behavioral issues, limited instructional resources, less experienced administrators,

underrepresentation in decision-making processes, and insufficient professional

development not the socioeconomic status of the students (Ingersoll, 2011). Teachers will

stay in high-poverty schools if there is adequate support (Nguyen et al., 2020).

Local Working Conditions

School Climate

Effective principals foster and nurture the school climate by creating a systematic

structure for staff and students that is built upon respect, trust, and unity with a focus on

student learning (Johnson et al., 2012). Administrators are visible in the building and

frequently encourage staff with regular and constructive feedback. Employees need to

hear recognition from their leaders (Sirota et al., 2005). A positive school climate

encourages colleagues to collaborate, take risks, and problem-solve (Johnson et al.,

2012). And, when instituting change or responding to issues within the building,

administrators in buildings with strong cultures have the ability and willingness to advocate for teachers to ensure staff needs are represented (Brantlinger, 2021). Administrators advocating for staff is not to take away their accountability or amount of responsibility, it is to make their building as effective as possible (Johnson et al., 2012). Improving working conditions is not creating easy jobs for teachers, it is about creating support structures and a strong building culture with an appropriate balance between autonomy and advocacy for teachers.

The climate of a building impacts retention for all stages in the career life cycle; however, it has a lasting impact on a new teacher. Grant and Brantlinger's (2022) study on teacher attrition rates found that "school climate in a teacher's first year teaching had long-lasting effects on their turnover, through 9 years, and possibly longer" (p. 55). An educator's first year of teaching shapes their impressions of the profession and impacts their work attitude. They found that teachers who reported poor building climate to be at a higher risk of leaving the profession within the first 2-4 years of teaching, and this risk only slightly decreases as they progress through their career (Grant & Brantlinger, 2022).

Administrator Effectiveness

Unlike teacher effectiveness, where there are numerous data points related to student academic growth in curriculum and skills, it is difficult to measure the impact of managerial efforts on school outcomes (King Rice, 2010). An administrator's efficacy depends on many factors related to the success of the building (Manasse, 1985). One outcome of an administrator's effectiveness is teacher retention within the building. This is because teachers are leaving their buildings due to concerns with leadership (Brantlinger, 2021). Educators desire an administrator who motivates them intrinsically

and extrinsically. Teachers benefit from leadership styles that promote empowerment and value teacher input (Thornton et al., 2008).

Geiger and Pivovarova's (2018) research on how working conditions impact teacher retention found that educators desire a principal who is visible within the building and has an open-door policy for staff questions and concerns. Educators are more likely to stay when they have a positive relationship with their administrators and feel supported (Geiger & Pivovarova, 2018). An effective principal establishes a school climate that sets high expectations for student and staff behavior, focuses on academic rigor, and engages parents in the school community (Johnson et al., 2012). A principal's ability to foster a culture where staff members collaborate and learn from each other is a key component of increasing teacher job satisfaction (Johnson et al., 2012).

When issues arise, especially related to student behavior, teachers expect the principal to intercede. According to Brantlinger's (2021) study on teacher retention, an educator's dissatisfaction with how administrative staff responds to discipline issues can be a motivator to leave the school. A teacher's decision to stay, leave, or migrate to a new building is dependent on the principal and the working conditions they establish within the school. Highly effective principals have increased rates of teacher retention. According to King Rice's (2010) research on principal effectiveness in the era of accountability, there is a direct correlation between an administrator's years of experience and their effectiveness. New principals are often placed in hard-to-staff buildings which tend to have more student behavior issues. This increases the likelihood that staff members feel under supported by their principal regarding responding to student misconduct, and this happens due to inexperience and not inability. The outcome remains

the same; however, staff turnover will increase in hard-to-staff buildings with both administrators and teachers. King Rice's (2010) study did find that when highly effective principals are placed in a hard-to-staff school, they will stay. The hurdle is in recruiting and retaining effective principals, especially in high-need schools, to retain staff.

Administrative Support

Supportive leadership has a large impact on a teacher's decision to stay in their current building, district, or within the teaching profession. A supportive leader plays a larger role in teacher retention than a teacher's sense of empowerment (Ndoye et al., 2010, p. 184). Supportive administration can result in higher levels of teacher job satisfaction even in high-need schools that face issues regarding annual student progress, lack of parental engagement, and low student performance (Whitfield et al., 2021). Administration plays a key role in retaining staff. Brantlinger's (2021) study confirms that 66% of teachers found a supportive leader to be an essential school attribute. This is because a supportive leader establishes a culture based upon trust and mutual respect which creates the foundation for risk-taking, continuous school improvement, and growth-focused teacher evaluations (Ndoye et al., 2010). Highly effective educators have high levels of enthusiasm and motivation. Engaged educators want to contribute to the organization and make a difference. So, the question for leaders is not how to motivate staff but rather how to keep them motivated so the best teachers can be retained, and the answer is support (Sirota et al., 2005).

An issue with supportive leadership is how and where administrators invest their time and resources. Regarding increasing staff morale, leaders focus on the bottom 5% of individuals who are actively disengaged about work (and who will likely tend to stay that

way) versus putting their energy in the top 95% of employees who do not display toxic behaviors (Sirota et al., 2005). This is especially true when protocols are implemented to address the 5% across the entire organization which can harmfully impact the morale of staff who do not need these additional policies. When an educator disagrees with their administrator's practices and finds them to be unsupportive, they are twice as likely to leave (Carver-Thomas & Darling-Hammond, 2019). This is because if a teacher perceives their administrator as unsupportive, they also find them unable to acknowledge staff accomplishments, less likely to encourage innovation, inept in clearly communicating initiatives, and mismanaging student behavior issues (Carver-Thomas & Darling-Hammond, 2019). Kersaint et al. (2007) elaborates that educators frequently reference issues with administrative support regarding student behavior as a major contributing factor in leaving the classroom. It is the administrators' responsibility to support the building by creating clear systems of response to student behavior and to be intentional about building teachers' behavior management skills.

Professional Development

STEM teachers need specialized and intentional development on problem-solving skills, classroom management, and techniques to minimize daily stressors, in addition to professional development on academic content and standards (Sass et al., 2012). Kersaint et al. (2007) found a positive correlation between teacher development and retention rates. Teachers who have professional learning communities, induction programs, mentoring opportunities, meaningful professional development, and opportunities to attend workshops had higher job satisfaction and retention rates. When a teacher feels stagnant in their career, they are likely to transfer or leave. Professional development,

grow-your-own leader programs, and other leadership opportunities increase teacher engagement in school and increase retention rates (Thornton et al., 2008). Teachers who experience meaningful professional development are 16% less likely to leave the profession than teachers who lack the same opportunities (Nguyen et al., 2020, p. 9). This is because teachers need to be placed in learning communities that provide the time and space for them to network, "learn about the latest research-based practices, attain strengths-based problem-solving skills, renew their commitment to teaching, and network with experienced teachers" (Sass et al., 2012, p. 21).

Induction and Mentoring

A key to improving teacher retention rates is staff induction procedures. Being a STEM educator entails a robust level of content knowledge coupled with strong pedagogical skills (Palermo et al., 2022). For a new STEM educator, the learning curve is steep and challenging to navigate alone which makes mentorship a vital part of retaining teachers. An effective mentor provides the scaffolded support a teacher needs to develop skills and pedagogy. A mentor is an expert in the field who does not hold an evaluative role with the STEM teacher. The traits of a mentor are reflective, supportive, and open-minded (Parker et al., 2021). New teachers need the proper support and training to be retained. This includes having a mentor within their content area/grade level, regular check-ins, professional development specific to a new teacher's needs, and regular constructive feedback to enhance their skill set (Sutcher et al., 2019). This must happen during the first three years of a STEM teacher's career because these years are the most critical for development and growth. It is during this formative period that a novice STEM teacher learns through trial-and-error, professional learning communities, and

mentorship (Henry et al., 2012). After the Great Recession, many states made major cuts to education. These budget cuts forced school districts to cut essential programming like new staff induction programs (Darling-Hammond & Podolsky, 2019). Teachers are expected to do more with less support and development which increases their chance of leaving the profession. When we lose novice teachers, we have a continuous cycle of underdeveloped and inexperienced teachers educating youth. Teachers do not reach their maximum level of effectiveness until five years into teaching and most educators leave before hitting this level of impact on student learning (Henry et al., 2012).

Collaborative Colleagues

Educators are more likely to stay when they have a supportive network of colleagues (Geiger & Pivovarova, 2018). There is a return on investment for employers to ensure that employees are building relationships with their colleagues. Creating cohesive teams for employees to collaborate when completing job tasks is an essential aspect of strong leadership (Sirota et al., 2005). In Brantlinger's (2021) study on stayers, leavers, and movers, 68% of teachers found collegiality and relationships to be a motivator to keep them in their building (p. 48). The four walls of a classroom can be isolating when dealing with the realities of education, teachers seek out and desire a sense of camaraderie that they are not alone in their day-to-day challenges (Ndoye et al., 2010). Collaborative colleagues are not venting in the teachers' lounge, it is the shared struggle and subsequent ideation and problem-solving that blossoms from relationships rooted in trust, respect, and mutual vulnerability. These relationships become the foundation for staff members to hold one another accountable, observe best instructional practices, and solve difficult problems as a collective unit (Johnson et al., 2012). When attrition rates

are high, teachers struggle to establish a consistent support network which impacts the organizational culture. By not addressing teacher turnover rates, a vicious cycle ensues. The working conditions that ensure high retention rates, such as collegial relationships, rely on keeping teachers because once a teacher loses their support network, they are more likely to consider moving schools or leaving the profession (Geiger & Pivovarova, 2018).

Classroom Autonomy

Over the decades, it has become apparent that the federal and state governments need to implement policies to ensure that all students receive equitable learning experiences. These legislative measures are imperative; however, an unintended outcome is the steady and gradual loss of autonomy for classroom teachers (Brantlinger, 2021). The dawn of "accountability" and business models, like Taylorism, being implemented in American schools to boost student academic achievements along with improve teacher efficiency has continued to take autonomy away from teachers (Mehta, 2013). Kraft and Lyons (2022) find "evidence consistent with the idea that teachers' perceived loss of professional autonomy over the last decade may be a salient factor for the decline in the state of the teacher profession" (p. 35). There is a steady increase in teachers who identify as being burned out and then make the decision to leave the field. Previously, a teacher who may have indicated burnout did not necessarily leave the profession because there were variables within their control that they could manipulate to decrease their burnout because they had higher rates of autonomy. With dwindling autonomy comes a lack of control and feelings of entrapment, leaving burned-out teachers feeling like the only option to improve their condition is quitting (Madigan & Kim, 2021). Garcia et al.

(2022), Nguyen et al. (2020), and Sutcher et al. (2019) all found a direct correlation

between a teacher's level of autonomy and retention rates. Highly trained educators want

their professional expertise to be acknowledged by providing them with the flexibility to

make determinations about how they structure their classrooms (Johnson et al., 2012).

Increased levels of autonomy provide teachers the space to use their pedagogical

knowledge to make instructional decisions in their classroom, increasing their feelings of

control and accomplishment at work (Müller et al., 2009).

Leadership Opportunities and Voice

While teacher autonomy is an educator's ability to make decisions regarding their

classroom, leadership opportunities and voice are related to larger-scale decisions outside

of an individual classroom. Teachers who have more control over decisions regarding the

selection of classroom materials, curriculum pacing, and building procedures are more

likely to stay in teaching (Sutcher et al., 2019). Administrators empower teachers when

they value staff input on operational decisions for the school (Ndoye et al., 2010) because

teachers are more motivated and engaged when they are a part of the process of

instituting change. When teachers have a seat at the table during decision-making, they

are more invested in moving the initiative along, speak positively with colleagues about

institutional change, and see themselves as a valuable part of advancing education

making them less likely to leave (Garcia et al., 2022). According to a study by Kraft and

Lyon (2022), teachers are reporting a steady decline in having control over instructional

decisions. Although buildings may hold meetings requesting the input of teacher leaders,

educators report these meetings feel more ceremonial than truly an opportunity for them

to influence the decision-making of administration or district leadership. This imbalance

between delegation and empowerment tips the scales in a teacher's perception of job satisfaction because teachers want to be treated like professionals with valuable expertise since administrative decisions have a direct impact on their classroom (Bassett-Jones & Lloyd, 2005).

Number of Class Preparations with Limited Plan Time

In secondary education, STEM teachers will frequently teach more than one content class meaning a mathematics teacher may be responsible for preparing Algebra Foundations, Algebra 2, and Geometry classes each day. These multiple preparations do not negatively impact teacher job satisfaction, STEM teachers find multiple class preparations to be intellectually challenging and they enjoy the variety in their teaching day (Goodpaster et al., 2012). Harrell et al. (2019) study of STEM teacher migration did not show a correlation between the number of teacher class preparations and teacher mobility. The median number of teacher preparations was two and teachers did not make decisions to leave due to feeling overwhelmed by the number of class subjects being taught (Harrell et al., 2019). Although teachers may not be leaving due to how many preparations they have, these preparations do bring additional stress when support and resources are lacking for the teacher. Harrell et al. (2019) advise not to generalize the impacts of class preparations on rural STEM teachers due to the large responsibility many rural teachers have being a department of one. When STEM teachers have multiple class preparations, it can be labor-intensive to create new and unique ideas for each curriculum (Goodpaster et al., 2012). The time commitment is compound when STEM teachers must account for differentiating their multiple preparations to address the various learning needs of students (Goodpaster et al., 2012).

One mechanism to offset the stress of multiple preparations is adequate planning time. According to Thornton et al. (2008), the movers and leavers in education reference the heavy workloads, with limited planning time, as a primary reason for work dissatisfaction that motivated them to find new employment. Teachers want the ability to complete their job responsibilities within the parameters of their contractual working hours. When teachers are given limited time to plan and prepare lessons, along with responding to other job requirements, they are forced to work long hours which increases teacher burnout (Darling-Hammond & Podolsky, 2019).

Class Size

Before the Great Recession, classroom sizes had been on the decline during the late nineties and early 2000s (Sutcher et al., 2019). After the Great Recession, many states made major cuts to education. These budget cuts forced school districts to eliminate course offerings which funneled more students into the classrooms that remained (Darling-Hammond & Podolsky, 2019). In the decade that followed, class sizes steadily continued to climb (Sutcher et al., 2019) and a teacher's access to para-professional support to assist with large class sizes dwindled significantly (Darling-Hammond & Podolsky, 2019). Teachers are doing more with less resources, support, and time. The effects are felt greatest by secondary teachers in gatekeeper classes that have high rates of student enrollment due to graduation requirements and students retaking. Djonko-Moore (2016) found that seventeen students are an ideal number in gatekeeper classes to ensure teachers can effectively and adequately feel confident about their ability to meet the individual needs of students, and each additional student that is added to the roster increases the odds of teacher job dissatisfaction. To get classroom sizes back to

pre-recession levels, many new teachers would need to be hired (Sutcher et al., 2019).

Conversely, Kraft and Lyon (2022) state that there is limited evidence of general

education class sizes impacting macro-trends in working conditions for educators. This

discrepancy in research calls for more investigation of teacher turnover trends in the past

decade and teacher voice related to classroom size and working conditions.

Student Achievement on Standardized Test Scores

Harrell et al.'s (2019) study indicates that STEM teacher mobility is not driven

by higher-performing students at another school. Even though math and science teachers

are not migrating to schools with higher test scores, these standardized assessments do

impact job satisfaction. When a teacher works in a high-performing school, they are

significantly more satisfied with their building working conditions (Geiger & Pivovarova,

2018). This increase in job satisfaction from working in a high-performing school

decreases the risk of teacher turnover by 10% in comparison to buildings with lagging

standardized assessment scores (Nguyen et al., 2020). According to Mehta (2013), this is

because STEM teachers are motivated by the opportunity to teach challenging lessons

and they are disenchanted when valuable instructional time is lost to standardized tests.

Teachers are not extrinsically motivated by continuously moving the needle on

standardized assessments, rather they are intrinsically motivated by hooking talented

students into STEM with an engaging lesson (Brantlinger, 2021).

In Texas, low-performing schools are penalized if students do not perform well on

accountability assessments and have low graduation rates, Sass et al. (2012) determines

that policymakers should be shifting from the symptoms to treating the cause. Teacher

attrition rates in lower-performing schools could be a major contributing factor to student

academic achievement due to the loss of established curricula knowledge, pedagogical skills, and institutional knowledge. According to School and Staffing Surveys (SASS) results, 25% of teachers who left the profession cited job dissatisfaction due to increased pressure from standardized assessments with low-achieving students (Sutcher et al., 2019). Secondary teachers experience greater levels of stress regarding high-stakes testing. According to Sass et al. (2012), teachers leave because they are dissatisfied with losing instructional time in preparing students on how to take the test and cramming in the curriculum. Yet, the question remains, are teachers leaving schools because of students not performing well or from dissatisfaction with being evaluated on their effectiveness in teaching students who are low performing due to socioeconomic status, not teacher ability, and not being able to dismantle a system not built for these students?

Student Behavior

One of the largest contributing factors to STEM teacher mobility is student behavior. In Brantlinger's (2021) study on NYC leavers, stayers, and movers in mathematics, a primary reason for teacher attrition is student discipline issues. According to Harrell et al. (2019) when a school has high rates of student behavior, a teacher is forty-five times more likely to move to a new school. In open-ended questions with leavers and stayers, Kersaint et al. (2007) found commonalities in respondents discussing elevated levels of stress associated with discipline issues in their classroom. When surveying movers and leavers, teachers identified problematic students as one of the top reasons for their job dissatisfaction and choice to make a change (Thornton et al., 2008). Teacher retention rates are directly impacted by local school demographics (Grant & Brantlinger, 2022) with a strong correlation between student behavior and STEM teacher

retention. Schools that have lower behavior incidences have higher STEM teacher retention because teachers can facilitate instruction as intended without having to contend with behavior (Ingersoll, 2011). Teachers are more likely to stay in schools with fewer student behaviors, lower proportions of minority groups, and higher student attendance (Grant & Brantlinger, 2022). Teachers are more likely to leave when they feel like most of their day is spent struggling with discipline issues.

Individual STEM Teacher Demographics

Gender

Females and males have different survival rates in the classroom. Male teachers have lower attrition rates (Garcia et al., 2022). Dr. Brian Stevens's (2023) *Research Practice Partnership: Teacher Turnover Patterns in the State of Nebraska* study of Nebraska student and staff data spanning from 1982 to 2021 confirms that female teachers have a higher probability of leaving the classroom before retirement age than their male counterparts with similar years of experience. STEM-specific, secondary male teachers in mathematics and science classes have similar survival ratings as elementary teachers, while secondary female mathematics and science teachers have an increased likelihood to migrate and leave education (Ondrich et al., 2008). It is important to note that gender has other implications, such as family obligations in which females are more likely to step away from the classroom to raise a family than males (Ondrich et al., 2008).

Age

Regarding teacher attrition, age is just a number. Sass et al. (2012) advises against using a person's age as a measure of attrition likelihood. When taking a macro view of

job turnover rates, young professionals are more likely to leave their first job within three to five years of employment regardless of the career. Nguyen et al. (2020) confirm that teachers over 28 years of age are less likely to turnover than their younger counterparts because job transitions happen more frequently in a person's early twenties. Sass et al. (2012) elaborates that teachers who enter the field at 25 years or younger are more likely to leave the field than teachers who enter the profession in mid-adulthood (between 25-30 years) or older adulthood (30 years plus). These statistics have more to do with an individual's decision regarding their career pathway than the educational profession itself.

Years of Experience

Rather than age, a more salient factor is a teacher's years of experience when analyzing teacher attrition. Factors that influence teacher attrition change with years of experience. Studying teacher attrition and years of experience can indicate the motivators and demotivators that impact a teacher's decision to leave (Day et al., 2006). Teachers who leave the profession at the beginning of their careers are leaving for varied reasons than educators who exit the field with more years of experience. Teacher attrition rates climb between the first year through the fourth year of teaching, after this point there is a slow gradual decline in attrition rates. This finding indicates that even when teachers are gaining expertise, they are still leaving the profession even in their prime of 4 to 5 years of teaching (Grant & Brantlinger, 2022). Novice teachers are more impacted by teacher voice and autonomy than experienced educators (Garcia et al., 2022). This indicates that young teachers need to be given more opportunities to contribute to school policies and be given more control in their classrooms. The United Kingdom study on the teacher life

cycle found that teachers within 0-3 years of teaching referenced a need for administrative and department support with student behavior concerns (Day et al., 2006). The impact of a teacher's first year is long-lasting. If a novice teacher experiences intentional onboarding it creates a positive impression and attitude towards the profession that they carry with them for the first 9 years of their career (Grant & Brantlinger, 2022, p. 55). This is especially true for complex content areas like STEM where strong pedagogy determines success (Henry et al., 2012). If districts want to retain new STEM teachers, they must invest resources into induction practices, so teachers experience instructional success with students early on (Palermo et al., 2022).

   As STEM teachers transition from the early career phase to the mid-career phase, attrition rates are on the decline until they reach around 11.5 years of experience in which attrition rates spike again (Garcia et al., 2022). At this point in their career, they are exiting for different reasons than before. Mid-to-late career teachers find salary to be one of the most powerful motivators to stay within their careers (Garcia et al., 2022). To retain mid-career teachers with a strong skill set, districts must create a compensation package that accounts for the expertise that these teachers bring to the district. Teachers with 4-7 years of experience found demotivation in heavy workloads while teachers with 8-15 years of experience cited a need for control over their professional development and desired to be elevated to more positions of responsibility (Day et al., 2006). Secondary STEM teachers are more likely to leave the profession mid-career to pursue administrative jobs (Sass et al., 2012). More research needs to be done on how different factors play into a teacher's choice to leave at the beginning, middle, and end of their

career. This information can allow districts to balance initiatives that will heighten a teacher's likelihood of staying in the profession.

Individual STEM Teacher Qualifications

Teacher Preparation

Teacher education programs play a pivotal role in adequately preparing teachers with skills and techniques to have a successful transition into a classroom. Graduating highly trained STEM teachers has been associated with lower rates of attrition for at least the first 2 years (Vagi et al., 2019, p. 125). This means that teacher education colleges cannot just focus on increasing the number of preservice teachers, they must be recruiting students who excel in STEM. To improve STEM teacher turnover rates, teachers need to be recruited who have characteristics of being highly motivated, strong academic performance, persistence, effectiveness in engaging an audience, and commitment to improving the field of education (Henry et al., 2012). This is not the time for colleges to lower the bar for admittance but rather to broaden their circle of recruitment. One promising avenue to recruit STEM teachers is to tap Mathematics, science, and engineering colleges for talented college students who would consider adding a teacher certification to their college degree. When comparing teacher certification avenues, recent mathematics graduates, who later added a teacher certificate, have higher retention rates than alternatively certified teachers who came from another career (Brantlinger, 2021).

Alternative Certification

As teacher vacancy rates in high-need areas soar, policymakers have actively pursued solutions related to alternative certification routes (Carver-Thomas & Darling-Hammond, 2019). Alternative certification does provide a quick solution to increasing the flow of teachers into STEM, foreign language, and resource positions which can alleviate local pressures to maintain class offerings and keep class sizes stable. The alternative certification strategy acts as a Band-Aid to fixing the supply and demand issue in high-need certification areas because alternative certification teachers do not have the long-term staying power of traditional certification (Ondrich et al., 2008). Teachers with traditional certification routes are 47% less likely to leave than teachers from alternative certification programs (Nguyen et al., 2020). However, if local districts can provide the necessary support to sustain an alternatively certified teacher past their first 2 years of teaching, the likelihood of retention will continue to climb with each passing year (Brantlinger, 2021). This is because when STEM professionals enter the classroom through alternative certification, they struggle more to adjust to the daily requirements and navigate school culture impacting their long-term retention rates (Brantlinger, 2021).

Furthermore, the local districts that employ the most alternatively certified math and science teachers are placing them in hard-to-staff buildings. Carver-Thomas and Darling-Hammond (2019) found that "in schools with the most students of color, 30% of mathematics and science teachers entered teaching via an alternative pathway, compared to just 12% of mathematics and science teachers at schools with mostly white students" (p. 13). Alternative certification programs may get more STEM teachers into hard-to-staff buildings initially, but it will not keep them there when they can transition back into

the health, engineering, and finance fields they left (Brantlinger, 2021). Alternative certification Mathematics and science teachers who are placed in Title I buildings have a turnover rate that is more than 80% higher than non-Title I buildings (Carver-Thomas and Darling-Hammond, 2019, p. 8). To combat alternative certification attrition in Title I schools local districts must provide intentional, continuous, and meaningful professional development that provides these teachers who entered teaching with less training than a traditional certification routes the necessary support for success (Garcia et al., 2022; Nguyen et al., 2020; Ondrich et al., 2008).

Content Specialty

STEM and special education teachers have the highest rates of teacher turnover, and these teacher attrition and vacancy rates vary among STEM content specialties (Nguyen et al., 2020). According to Sass et al.'s (2012) study where they ranked attrition rates by content specialty, middle school mathematics had the highest turnover followed by high school science teachers, then high school mathematics, and finally middle school science teachers. Elevated attrition rates in mathematics can be attributed to teachers having feelings of disenchantment with teaching mathematics (Brantlinger, 2021). The primary focus of local district and school improvement plans focuses on increasing students' scores in reading, writing, and mathematics which can compound into more stress and less job satisfaction. These factors make teachers with degrees in mathematics more likely to leave the classroom (Grant & Brantlinger, 2022).

Regarding science, the shortage of science teachers is not equal. According to Australian Council of Deans of Science (ACDS) study results, there is no shortage of biology teachers; however, a significant shortage of physics and chemistry teachers

(Harris & Farrell, 2007). Physics positions are one of the most difficult subjects for schools to hire and fill because there are higher rates of attrition of novice physics teachers (Palermo et al., 2022). The level of pedagogical knowledge that is needed to teach physics, which is heavily rooted in mathematics, creates a steep learning curve for new educators. When new teachers receive constructive feedback, without access to necessary development and resources, these negative ratings from the administration cause novice teachers to switch careers (Vagi et al., 2019). For experienced STEM teachers who enter a state, numerous roadblocks prevent qualified STEM teachers from filling vacant teacher positions, such as, state requirements for licensing, teacher certifications not passing state lines, and pension packages not transferring across districts (Dee & Goldhaber, 2017). So, the solution for local districts is to have biology teachers, in which there is adequate supply, instructing classes outside of their field of expertise. The implication of such decisions is these biology teachers have insufficient pedagogical knowledge in their out-of-field content area, decreasing the teacher's self-efficacy and increasing their likelihood of searching for a new position (Polizzi et al., 2015). The larger-than-average attrition rates in STEM fields can be attributed to vacant positions being filled by out-of-field or underqualified educators (Ingersoll & Perda, 2010).

Leadership Aspirations

STEM teacher attrition from the classroom does not always equate to educators leaving the profession entirely. The field of education promotes and reinforces graduate degrees by moving teachers across the salary scale when they obtain higher levels of education. Refining a teacher's practice through graduate work improves student

outcomes and retention rates. Teachers who are highly qualified to teach have more years of experience, and have master's level degrees, are more likely to stay in education (Garcia et al., 2022). With valuable expertise, teachers want to contribute to education on a larger scale. Teachers with advanced degrees are often associated with taking on additional leadership roles within the school or district (Ondrich et al., 2008). Secondary teachers are more likely to leave the classroom in years 3 through 8 to pursue administrative jobs (Sass et al., 2012). The teacher's decision to leave the classroom is not necessarily associated with dissatisfaction with the profession but rather a desire to influence change and support education at a higher level (Ondrich et al., 2008). A teacher's career aspirations and level of expertise can move them up and out of the classroom creating new STEM vacancies (Brantlinger, 2021).

Individual STEM Teacher Career Satisfaction

Many STEM teachers who leave the field before retirement age cite dissatisfaction with teaching as their primary reason to pursue another career (Ingersoll, 2011). A teacher's perception of the hygiene factors and motivating factors in their workplace impact their willingness to stay in education (Bassett-Jones & Lloyd, 2005). Numerous factors impact a teacher's job satisfaction, and this varies based on individual voice.

Work-Life Balance

Teachers leave education because the demands of the job create a work-life imbalance. The requirements on teachers and working conditions during the teaching day do not allow for teachers to complete all aspects of their job causing them to sacrifice

time with family to lesson plan, grade, and complete other required tasks (Kersaint et al., 2007; Thornton et al., 2008). Compared to other countries, United States teachers have less planning and preparation time and more hours of teaching in front of students each week (Darling-Hammond & Podolsky, 2019). Providing teachers with limited time to complete job requirements forces them to choose between family responsibilities and job obligations leaving one domain of their life to be sacrificed for the other (Kersaint et al., 2007). A survey conducted by Barmby (2006) indicates that teachers are deciding to leave the field of education due to extensive hours of work and high-stress levels that are not offset by acceptable wages. Teachers will stay in their current roles if they find their position to be competitive regarding pay, work-life balance, and job satisfaction. If there is an imbalance between their perceptions of teaching and potentially better working conditions, a teacher is likely to leave the field (Geiger & Pivovarova, 2018). Teacher migration is likely if an educator perceives another district to have higher salaries and better working conditions for the same level position (Geiger & Pivovarova, 2018).

Lack of Accomplishment

A contributing factor to a teacher's career satisfaction is their perceived effectiveness. According to Bassett-Jones and Lloyd's (2005) modern-day replication and analysis of Herzberg's Motivation-Hygiene Factors, one of the biggest motivators for employees is feeling a sense of accomplishment at work. Sirota et al. (2005) found that employees must feel a sense of achievement regarding the purpose and impact of their work, allowing them to feel pride in their accomplishments. When teachers have negative perceptions about their abilities both their motivation and self-esteem are impacted (Madigan & Kim, 2021). To keep employees engaged at work, a leader is challenged

with ensuring that the staff member is provided with a sense of accomplishment by completing tasks with the appropriate amount of struggle and success, so they are continuously acquiring new skills (Sirota et al., 2005).

Burnout

STEM teachers do not find their working conditions to be sustainable in the long term. According to Kraft and Lyon (2022), from 2018 to 2022, "the percentage of teachers who say teaching is still worth it despite its stress and disappointments has declined from 72% to 44%" (p. 34). Over time, the increased demands placed on teachers have amplified pressures and overstretched teachers. Madigan and Kim's (2021) study on teacher attrition found that teachers who have between 10 - 12 years of experience cite having the highest levels of burnout and intentions to quit due to reduced job satisfaction. Teacher burnout is occurring in conjunction with a decline in teacher prestige and rising workloads (Geiger & Pivovarova, 2018). It is hard for teachers to commit to education when they do not feel the support of the community. Three primary factors cause teacher burnout: exhaustion, depersonalization (loss of autonomy), and reduced accomplishments at work (Madigan & Kim, 2021). One avenue to decrease teacher burnout is to adjust working conditions because a teacher is 45% less likely to leave a school when they do not experience arduous circumstances (Nguyen et al., 2020). And increasing staff morale has a cyclical effect on outcomes. Staff members who are satisfied with their work create positive classrooms for students to learn. When student motivation and engagement increase, so does student learning. Staff members feel a sense of accomplishment when student outcomes increase, which increases their morale and motivation causing the cycle to continue (Sirota et al., 2005).

Justification of Framework

Literature related to national trends in teacher attrition establishes that teacher attrition cannot be specifically aligned to one factor but rather a combination of multiple compounding factors that motivate a STEM teacher to leave the classroom. These factors of attrition happen at different levels of control from national, state, local districts, local schools, and individual teachers.

As identified in the literature review, at the national level, national accountability measures; the national workforce; current and projected vacancies; and a competitive job market are factors that influence teacher attrition. At the state level, state accountability measures, the state workforce, and state STEM teacher vacancies impact teacher retention and attrition rates. Local factors fall into two categories, local demographics, and local working conditions. The local demographics that impact a teacher's decision to stay in the field until retirement age are local district salary and benefits; local school type, locations, and level; and Title I, poverty rates, and free and reduced lunch programs. The local working conditions that impact STEM teacher career decisions are school climate; administrator effectiveness; administrative support; professional development; induction and mentoring processes; collaborative colleagues; classroom autonomy; leadership opportunities and voice; number of classroom preparations with limited plan time; class size; student achievement on standardized test scores; and student behavior. Literature review studies indicated that individual teacher demographics, qualifications, and career satisfaction can impact teacher retention, mobility, and attrition. Individual teacher demographics include gender, age, and years of experience. Individual STEM teacher qualifications encompass teacher preparation, alternative certification, content

specialty, and leadership aspirations. Individual STEM teacher career satisfaction looks at work-life balance, lack of accomplishment feelings, and burnout.

To inform future policies and procedures to curb STEM teacher attrition rates, research must be conducted to uncover themes and patterns in what influences STEM teachers to leave the field before retirement age. Identifying influences that contribute to attrition along with which level these factors are established will allow for specific recommendations to be made at the national, state, local, and individual level to improve teacher retention rates and strengthen the teacher pipeline, as seen in Figure 2.

Figure 2

STEM Teacher Attrition Conceptual Framework with National, State, Local, and Individual Influences for Teacher Attrition
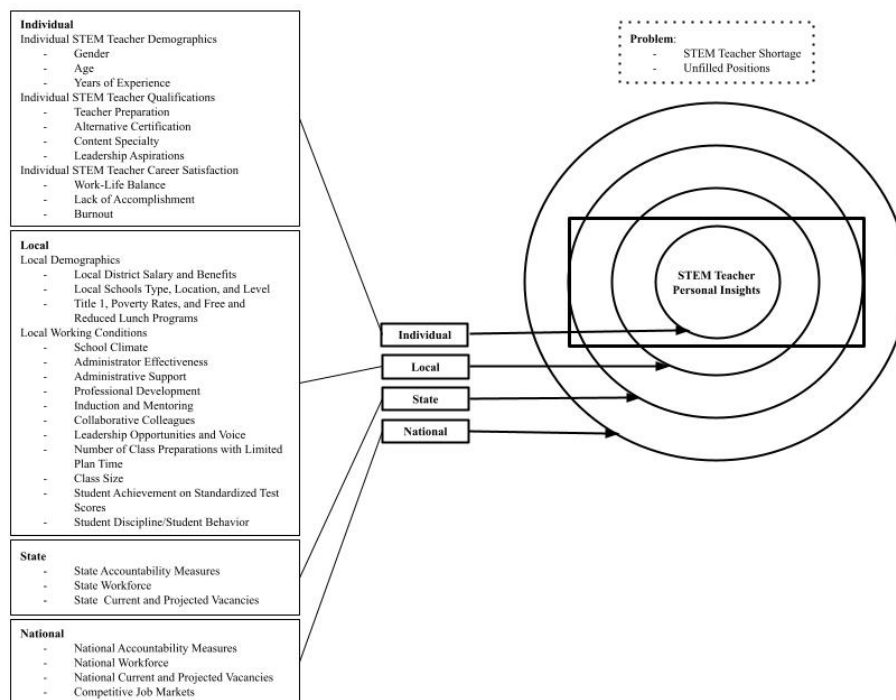
Note. Explanation to clarify information in the image. Adapted from The Correlates of Teacher Turnover: An Updated and Expanded Meta-Analysis of Literature, by T.D. Nguyen, L.D. Pham, M. Crouch, M.G. Springer, 2020, *Educational Research Review*.

Chapter 3

Methods

Purpose

This study will analyze STEM teacher personal insight to identify STEM teacher turnover patterns in Nebraska. The results contribute to the larger story of the Nebraska teacher pipeline. It provides academic merit to the field by supplying data to inform school leadership in decision-making regarding policies and procedures. Additionally, it benefits the field by educating stakeholders on STEM teacher attrition in order to mitigate conditions that contribute to high turnover rates.

Research Question

- Describe influences that impact Nebraska STEM teacher attrition through the experiences of recent Nebraska STEM teachers who have left teaching.

Framework

The STEM Teacher Attrition Conceptual Framework visually depicts the levels at which decisions regarding educational policies, procedures, and conditions are determined at the national, state, local, individual levels which can impact STEM teacher retention and attrition rates. This is clearly indicated in Figure 3 with four nested circles depicting national, state, local, and individual conditions with a rectangle intersecting all levels for teacher voice. Through multiple case study interviews, this qualitative study analyzed former Nebraska STEM teachers' individual experiences on what motivated

them to leave the classroom. Data coding and analysis aligned individual teachers'

perspectives on what motivated them to leave the STEM classroom with national, state,

local district, local school, and individual teacher influences to uncover themes and

patterns in STEM teacher attrition.

Figure 3

STEM Teacher Attrition Conceptual Framework with National, State, Local District, and

Local School, and Individual Teacher
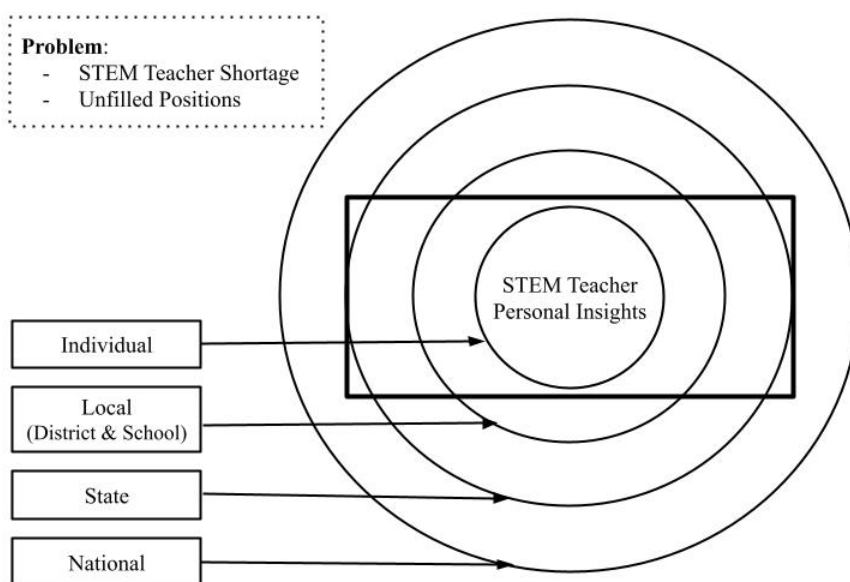
Design of the Study

     This study investigated factors that impact STEM teachers' attrition from the

classroom. Qualitative data from the multiple case study interviews captured the voice of

STEM teachers who have left the classroom in the last 5 – 10 years.

Participants

     A criterion sampling was used in this former Nebraska STEM teacher multiple

case study (Merriam & Tisdell, 2016). Participants were intentionally picked to hear the

individual stories of former STEM teachers from mathematics, science, and STEM

contents; a variety of years of experience; and differing career decisions after teaching.

The participants in this study were secondary teachers who have taught STEM courses in

middle school, high school, or both. This group of Nebraska STEM teachers

encompassed urban, suburban, and rural districts. Participants' ages spanned from mid-

twenties to late forties. Their combined perspectives reflected early, mid, and late career

life cycles. All participants in the study were no longer teaching in the regular classroom.

Their attrition has occurred within the last 5 - 10 years and before retirement age. The

next steps in their careers could vary from positions in district-level leadership, Nebraska

Department of Education, university faculty, non-educator positions in the private sector,

and staying at home. The former STEM teachers participated voluntarily. Participant

interview data was collected and recorded with non-identifiable information to protect

and minimize risk to the individual and their former employer(s).

Instrumentation

The former Nebraska STEM teachers multiple case study instrumentation was

semi-structured interviews. There were four primary questions. Questions fell into the

following categories of the research: personal narrative for motivators to become a

teacher; realities of leaving the classroom; STEM teacher attrition influences; and the

recruitment and retention of STEM teachers (Savin-Baden & Major, 2022). The teacher

voice variables that were measured related to a teacher's personal perspective on the

career decision-making process and their motivators to leave the classroom. The

interview questions provided an opportunity for teachers to discuss their attrition from the

classroom as it relates to influences at the national, state, local, and individual levels.

Each interview question seeks to obtain information regarding individual former STEM teachers' feelings and perceptions regarding their attrition from the classroom through a confirmatory research technique (Miles et al., 2020). All questions underwent thorough review and critique from experts in qualitative research. The provided feedback was implemented to reword and adjust questioning. Prior to interviewing case study participants, questions were practiced on former non-STEM teachers to ensure the instrument was valid and reliable. The researcher assessed the comparative testing to see if the questions were clear for the interviewees and if responses were appropriately related to attrition. Another phase of edits and revisions occurred at this time. The outcome of the multiple case study interviews used deductive and inductive coding to find and establish themes in STEM teacher attrition. This deductive coding employed predefined categories derived from existing theories referenced in chapter 2, whereas inductive coding allowed for the emergence of new themes directly from the interview data, offering flexibility and openness to unexpected findings in multiple case study analyses.

Procedures

Step-by-step account:

- **Initial contact**: Initial contact with former Nebraska STEM teachers requesting their voluntary participation in a STEM teacher pipeline attrition study.

- **Permissions to Participate**: Per IRB protocol, the researcher had an active consent form. These were signed by participants prior to scheduling interviews.

- **Case Study Interviews**: The multiple case study interviews occurred online using

a secure digital video conference platform. Table 1 explains the multiple case study protocols for conversation along with the semi-structured interview questions. During the individual interviews, one researcher conducted all the questioning while observing the former STEM teacher's body language and tone and taking copious notes (Savin-Baden & Major, 2022). All interviews were video recorded, with participant permission, and transcribed using the video captioning software provided on the platform.

- **Data Collection**: Quantitative data was collected during the multiple case study interviews using interviewee notes, review of video recordings, and live transcripts.

- **Data Cleaning**: All data was cleaned to remove identifying information of the participant, such as teacher name and their former school district(s) to protect interviewees' anonymity. The researcher's notes and transcripts were cleaned to remove typographical errors and ensure readability.

- **Member Checking**: After summarizing results, the researcher shared the summary of results with the interviewee to see if they had additional comments or if they did not agree with the summarized content. Member checking verified the accuracy of the data prior to uploading summaries and transcripts into a qualitative coding platform.

Table 1

Multiple Case Study Protocol for Conversation

Category: Personal narrative for motivators to become a teacher. **Intent:** The opening question is for relationships and trust building. Also, it intends to get a picture of why the individual chooses to become a teacher. Their reason for becoming a teacher could play into their reasons for leaving.

Question 1: Tell me about your journey into education.
Follow-Up/Listen For:
- What made you want to be a teacher?
- Describe your degree path/teacher preparation experiences.
- Describe your teaching career:
  - Classes taught.
  - Years of experience.
  - Number of buildings.
  - What brought you joy?

Category: Realities of leaving the classroom.
Intent: To gain insights into former STEM teachers' current jobs and the comparison of their current position with teaching.

Question 2: Tell me about your professional life since teaching in a classroom.
Follow-Up/Listen For:
- What did you gain in your new role?
- What is the difference (compare teaching vs. not)?
- What did you have to give up for your new role?

Bridge: So, it sounds like you are in an exciting new role. So now, what I want us to do is to go back to when you came into this place. You started as a teacher back in ___, and here we are today in 2023/2024, now let us talk about the stuff in between.

Category: Influences on STEM teacher attrition.
Intent: To understand what motivates a STEM teacher to leave the classroom.

Question 3: Tell me about your journey of leaving the classroom.
Follow-Up/Listen For: Listen carefully for what they found compelling or interesting in their new job position that motivated them to apply. Listen carefully for income/salary, benefits, retirement, work-life balance, etc.
- The journey to leave the classroom is not made quickly. Describe when you remember considering leaving the classroom.
- What was different about that last one, compared to those other times when you stayed?
- What were some things you considered regarding leaving?
- Was there anything else that went into that decision?
- Were there business elements that went into that decision?
- How did your lifestyle need impact your decision?
- What did you find compelling or interesting in your new job position that motivated you to apply?
- What were you looking for to be better in your next step than what teaching could provide?
- Has your position or place of employment changed since you first left the classroom? (listen for how many positions or employer moves they

have made).   -   <u>General</u>: Describe that decision-making in a little bit more detail.
Category: Recruiting/Retaining STEM Teachers **Intent**: Determine influences that would motivate a former STEM teacher back into the classroom. **Question 4**: So, think about where you are today, would you ever consider returning to the classroom? What would entice you to go back to the classroom?

Data Collection and Analysis

In the multiple case study interviews of former STEM teachers, the researcher collected data by real-time notes of the responses, body language, and tone of interviewees; live text transcription scripts generated by video captioning software; and reviewing video recordings of the interview. Researcher notes and transcriptions were cleaned to remove any personally identifying information of the participant or their former school district(s) and replaced with pseudonyms. Intelligent transcription was used when cleaning the transcripts to remove filler words and resolve grammar issues, while keeping all dialogue content, to increase the readability of the transcripts (Saldaña, 2021). Transcripts were uploaded into a qualitative coding platform for analysis where data was coded and examined.

The multiple case study interview transcripts were coded using a combination of deductive and inductive approaches. The first round of open coding was a top-down approach. The deductive coding categories for this initial round of coding include national, state, local (district), local (school), and individual. A ground-up approach was implemented for the additional rounds of coding where the researcher used both selective coding and thematic analysis coding (Saldaña, 2021).

These codes were analyzed for meta-themes that warrant further inductive coding.

Using a qualitative coding platform, codes were tallied and compartmentalized so codes with the highest frequency could be further analyzed, new themes could emerge, and nested sub-codes can be created (Miles et al., 2020). During the coding process, the researcher established and used a codebook for all parent codes, sub-codes, and nested codes by using the memo feature in the qualitative coding platform. Each code memo included descriptors and examples to maintain consistency, increase clarity, and minimize discrepancies during the coding process.

Summary

STEM teacher attrition in Nebraska was studied through a qualitative analysis of STEM teacher turnover patterns. Former STEM teachers provided voice and perspective to STEM teacher attrition through semi-structured case study interviews. This qualitative data was analyzed to find congruency and differences in order to unpack the influences in STEM teacher attrition.

Chapter 4

Results

This qualitative study analyzed STEM teacher personal insight to identify STEM teacher turnover patterns in Nebraska. Eleven former STEM teachers participated in semi-structured case study interviews sharing their individual experiences of transitioning out of the classroom. The central research question of describing influences that impact STEM teacher attrition through the experiences of recent Nebraska STEM teachers who have left teaching was answered through compiling participant responses and shared experiences surrounding teacher turnover. The findings provide academic merit to the field of education by supplying data, through individual narratives, which inform school leadership on decision-making that impacts teacher attrition. These findings benefit the field by educating stakeholders on patterns in STEM teacher perceptions of attrition in order to mitigate conditions that contribute to high turnover rates.

Participant case study responses underwent multiple iterations of coding. Categories and subcodes were placed into clusters based on commonalities in participant perceptions of attrition (Miles et al., 2020). Through making contrasts and comparisons, elemental variables were partitioned or subsumed to establish subthemes. Through factoring, subthemes have been nested under main themes with the use of category and subcode counts (Miles et al., 2020). The code counts provided insight on density of participant responses and the frequency of comments which demonstrated how many participants, and how often, a variable was discussed. Response density and frequency only organizes the cumulative data; however, the narrative from participants depicts the

actual severity of the message and the impact of the individual shared experience. As shown in Table 2, this qualitative coding process yielded subthemes nested under the main themes: individual teacher demographics, teacher qualifications, individual perceptions of STEM career, building working conditions, internal building systems, building demographics, district level systems, and district level support structures.

Table 2

STEM Teacher Attrition Response Themes (N = 11)

Main Themes and Nested Subthemes	n	Frequency
Individual Teacher Qualifications		
Teacher Pathway	8	
Alternative Certification	3	
Leadership Aspirations	10	
Individual Perceptions of STEM Career		
Career Satisfaction	11	123
Career Dissatisfaction	11	153
Local Building Working Conditions		
Workload	10	43
Student Behavior	10	37
School Climate	8	33
Administrative Dispositions	8	32
Colleague Relationships	10	28
Leadership Opportunities and Voice	8	26
Parental Support	7	24
Local Internal Building Systems		
Administrative Tasks of Leadership	10	42
Mentoring	10	39
Plan Time	9	24
Student Discipline	8	16
Professional Learning Communities	5	16
Local Building Demographics		
Location: Urban, Suburban, Rural	11	39
Level: Middle School or High School	11	9
Title I, Poverty Rates, Free and Reduced Lunch	4	6
Local District Level Systems		
Salary and Benefits	10	33
Paid Time Off (PTO)	4	27
Professional Development	7	25

Main Themes and Nested Subthemes	n	Frequency
District Level Support Structures		
Board of Education and District Level Support Structures	4	18
Administrative Support and Advancement Structures	2	15
Building Support Structures	5	9
Student Support Processes	3	5
District and Community Support Structures	1	6

Note. Responses from the Nebraska STEM teacher attrition semi-structured case study interviews are grouped by main themes with nested subthemes. n = the number of participants who addressed each subtheme; Frequency = the number of times the subtheme was discussed. Cells have been shaded from lowest to highest numerical values.

Participants Journey Out of the Classroom

To provide context and understanding of the themes and subthemes from former STEM educator's personal insights, it is essential to discuss the participants journey from the classroom. Four out of eleven participants transitioned into positions outside of the school district. These teachers mentioned being pulled out and recruited due to their transferrable skills in other fields, such as, business, medical staffing, and positions in higher education. All but one educator misses working with students. Others make comments similar to, "returning to the classroom has crossed my mind"; however, each of them states how working conditions have drastically improved in their new jobs. They reference elements of work-life balance, unlimited time off, less stress, more autonomy, and equal or higher salaries.

The next batch of teachers described being pulled up into leadership positions within districts. Four out of eleven participants now are a building administrator or in a district leadership position. They, too, reference missing the direct impact and individual connection with students. "I have a wider breadth of interactions with students, yet the

depth just isn't there anymore." Another educator misses the "aha moments" and daily discovery that teaching offers. Each individual referenced cherishing classroom interactions with students in their new role. Yet, none of them plan to return to teaching. These reasons for remaining in current positions include higher salary, more work-life balance, and that they find meaning in professionally developing staff and engaging with educational practices at a higher level.

The remaining three participants experienced a pushed-out feeling. These teachers' reference being so compelled to leave that they exited the classroom before having a new position lined up. Although all three educators miss the relationships and the feelings of joy associated with helping students and improving their educational trajectory, these feelings of satisfaction toppled under the weight of burnout, poor leadership, a lack of accomplish in changing systems, and work-life balance. Each of them works full-time or part-time in positions connected to the field of education, where they are making equal or less money than they did teaching. Each participant experiences flexibility, respect, and autonomy in their new position.

Participants' Perception of Individual Teacher

Case study participants were selected based on accessibility to the researcher. To protect the identities of this sample of convenience, teacher demographics, qualifications, and responses will be described holistically. To tell the story of attrition, educator responses have been compiled, paraphrased, and summarized, while still including key quotes and words, so the individual participant unique narrative is retained.

Participant responses related to their career journey are organized into the main themes of teacher demographics, teacher qualifications, and STEM career. Subthemes

and categories surfaced during thematic analysis. These elements are in sequential order of highest density in participant responses and code frequency. The organization of responses into main themes, subthemes, major categories, and minor categories provided for a clearer picture of former STEM teacher's perception of their career, and ultimately, their attrition from the classroom (see Figure 4). The number of participants and frequency of comments assists in framing the context of STEM teacher attrition from the classroom, with the most important information coming from personal narratives.

Teacher Demographics

Teacher demographics vary greatly depending on location, with factors such as age, gender, and years of experience influencing the makeup of the teaching workforce. Teacher demographics, including age, gender, and years of experience, play a crucial role in shaping educational environments, influencing instructional methods, student-teacher relationships, and the overall effectiveness of teaching practices.

Gender. Nine participants identified as female and three identified as male.

Age. Participants' ages spanned from late twenties to mid-fifties. A majority of teachers fell between the range of 40 to 45 years of age.

Years of Experience. The years of experience spanned four to nineteen years. The breakdown is 4, 6, 8, 9, 12, 13, 14, 15, 15, 16, and 19 years of experience. The median is 12 years of experience.

In closure, multiple case study interviews have revealed that there is no discernible trend in teacher attrition based on factors such as gender, age, or years of experience. This suggests that other variables may have a more significant impact on teacher retention.

Figure 4

Individual STEM Teacher Attrition Response Themes

Minor Category	Major Category	Subtheme	Main Theme

Undeclared (n = 27%)
Declared (n = 18%)
Switched Major (n = 18%)
Second BA (n = 10%)

Teacher Pathway
(n = 73%)

Alternative Certification
(n = 27%)

Teacher Qualifications

A Desire to Lead
Leadership Development and Training
Teacher Leader Roles

Leadership Aspirations
(n = 91%)

Help, Guide, & Impact Students
(n = 91%, comments = 24)
Inspire & Improve Student Learning
(n = 73%, comments = 23)
Building Relationships & Connections
(n = 73%, comments = 16)
Creativity & Innovation in Lesson Planning
(n = 64%, comments = 19)
A Passion to Instruct and Teach
(n = 45%, comments = 13)
Accomplishment in Building Capacity in Systems & People
(n = 45%, comments = 12)
Content
(n = 45%, comments = 10)
Teacher Schedule & Routine
(n = 27%, comments = 6)

Career Satisfaction
(n = 100%, comments = 123)

Lack of Accomplishment with Students
(n = 91%, comments = 20)
Lack of Accomplishment with Job Performance
(n = 27%, comments = 9)
Lack of Ability to Change Systems
(n = 27%, comments = 4)

Lack of Accomplishment
(n = 100%, comments = 33)

Perception of STEM Career

Inability to Reduce Work Overflow
(n = 91%, comments = 23)
Juggling a New Baby
(n = 45%, comments = 15)
Comparison with New Job
(n = 18%, comments = 7)

Work-Life Balance
(n = 91%, comments = 45)

Career Dissatisfaction
(n = 100%, comments = 153)

Physical or Mental Health Concerns Due to Burnout
(n = 64%, comments = 17)
Feeling Associated with Burnout
(n = 55%, comments = 16)
A Change in Personal Relations Due to Burnout
(n = 45%, comments = 9)
General Burnout
(n = 36%, comments = 7)

Burnout
(n = 82%, comments = 49)

Want Autonomy Back
(n = 45%, comments = 6)
Lost Autonomy
(n = 36%, comments = 12)
Had Autonomy
(n = 27%, comments = 8)

Autonomy in Decision Making
(n = 82%, comments = 26)

Note. N=11. Subthemes, major categories, and minor categories are organized from highest density in participant response and highest frequency in comments. Colors are to designate between main themes.

Teacher Qualifications

Teacher qualifications encompass a combination of educational credentials, such as degrees or certifications in relevant subjects, pedagogical training, and practical experience, enabling individuals to effectively instruct and support students in academic settings. The following subthemes for teacher qualifications: teacher pathway, alternative certification, content specialty, and leadership aspirations.

Teacher Pathway. Regarding teacher pathway, eight out of eleven participants followed a traditional degree pathway while three participants received alternative certification. Two of the eleven participants declared a teacher education pathway at the time of college admissions. One educator stated, "I can't trace it back to the exact moment when I had this epiphany that I wanted to be an educator, but I had an eighth-grade math teacher that I can immediately go back and say there was some influence there."

Three participants weighed multiple potential degrees before declaring teacher education. For example, one teacher had considered a degree in nursing or physical therapy because they wanted to help people; however, after helping a friend with calculus they realized, "This is so fun. I can help people, and I can do math. I'm gonna be a math teacher."

Two participants switched their major to education during the first few years of college. One educator first declared a major in Actuarial Science without knowing what the degree entailed. They elaborated, "When I was in high school, my mom was looking up career fields that would be good for people who had a strong math background. And this sounded like something I could be good at." By sophomore year, the participant

switched their degree to math education.

One participant received an initial Bachelor of Fine Arts (BFA) and then earned a second Bachelor's of Science in Education. With their BFA degree, this educator's job included performing bullying and dating violence education skits in schools, and they explained "I really liked it, and I loved going into schools and I was like, wait, is this what education is? Maybe I want to go to education."

Alternative Certification. Three participants took an alternative certification route into education after earning a bachelor's degree in an area of science or mathematics. All three of these educators obtained a master's degree while completing secondary teacher certification requirements. For example, one participant describes dissatisfaction working in a university lab environment and an influential conversation with a colleague:

> He's like, hey, you know, there's this program where people with bachelor's degrees can get teaching degrees, and you talk to me about how much you love teaching, you know, so why don't you check that out? And I'm like, you know what? I will check it out. And you know, in my mind I'm like, oh my god, I always said I wasn't going to do what mom did, and here I am.

Content Specialty. Participants' various degree pathways and continuing education resulted in the following content specialty: Biology, Business, Curriculum and Instruction, Dual-Language Endorsement, Educational Leadership, Elementary Education, English, Middle Level Endorsement, Mathematics, Science, Secondary Education, Spanish, and Theater.

In summary of education journey and content specialty, participant responses did not indicate that a teacher's degree pathway or content area is a major contributing factor in predicting teacher attrition. It may be interesting to note that a STEM teachers degree pathway may influence the job position they move into. For example, none of the alternatively certified STEM teachers transitioned into building or district leadership roles. These alternatively certified teachers took corporate jobs or positions in academia. While the traditional teacher pathway educators left the classroom for administrative positions in a school district, at the Nebraska Department of Education, or in medical staffing. And, although mathematics teachers did discuss more concerns with teaching multiple courses, they did not signify that having more class preparations than other colleagues as a primary reason for attrition.

Leadership Aspirations. Ten out of twelve participants held teacher leader roles or aspired to a level of leadership outside of the classroom. Leadership aspiration codes fell under the categories of a desire to lead; development and training; and teacher leader roles. These leadership aspirations can be described as a participant's interest in taking on additional responsibilities within their building, district, or state related to the improvement and advancement in the profession.

A Desire to Lead. A few participants had a strong desire to lead outside of the classroom environment. One felt a calling, "like I have a purpose," and I am meant to make an impact outside of the classroom. One had a "desire to stretch myself as an educator in educational leadership … further my own education and support the learning and education of my colleagues." Another participant looked into leadership because they did not want to feel stagnant. While a different educator mentions wanting to go into

administration "because of the impact."

Also, there are pockets of participants who did not desire the actual role of administration, they only wanted to lead in order to develop themselves as educators. One teacher describes pursuing a degree in educational leadership, not because they wanted to be an administrator but to gain skills and expertise. They think leaving the classroom for administration "sounds terrible." Another educator said they did not plan to leave the classroom, they just wanted to try out the district's leadership pathway program. Both of these educators had been encouraged by others to apply for leadership roles, which they attained, promoting them up and out of the classroom.

A couple of participants wanted to lead and did not get the opportunity, and instead, left their district or the education field entirely. For example, one teacher was interested in becoming an assistant principal or a staff development leader, yet they felt like the district already had their "it" people. "The same people always seem to land every single job. I didn't ever feel like I would have an opportunity." Another shared that they were not getting leadership positions in their former district, so they switched to a new district. While another participant described being overlooked for leadership a couple of times, "I'm not mad about it;" however, they did leave education for a cooperate job.

Other teachers left education for career advancement. One mentioned leaving teaching because "you are pretty stagnant … unless you want to go into administration or work at the district level." One participant described themselves as a learner and they wanted a chance to make a difference, so now they get to lead in a different way in a non-education job. Another left teaching for leadership opportunities in a company where

there are clear advancement tracks, and more earning potential as you gain expertise. A different educator explains that they could have gone into building leadership, but they did not want to be a principal or a curriculum person, so instead they moved into academia.

Leadership Development and Training. Five participants found that obtaining a master's degree opened doors to leadership roles in and outside of education. Four teachers found their district's leadership pathway program influential in their career journey. One educator highlights an experience of being "able to walk alongside a facilitator for a little while, and I was able to see what that work entails." Another describes how "the experiences that [they have] been provided" prepared them for administration. Three teachers recount how mentors influenced them to move into leadership. One of these participants mentions working closely with district leadership during different curriculum writing cycles and felt like they could see themselves in a similar leadership role. Another educator had "a hard time giving up the classroom" until they started shadowing some principals and district leaders, in which they then realized that an administrator has lots of opportunities to interact and influence students. This same participant felt like their principal planted seeds of leadership in them. The third felt being mentored by a lot of good leaders allowed them to "pick and choose the things you like from the teacher lens and colleague lens and decide what you want to carry with you into your own leadership position."

Teacher Leader Roles. When educators recounted their path into teacher leader and/or administrative roles their responses fell into buckets related to enacting change, advocacy, and building capacity. When participants spoke of enacting change and a need

for advocacy, their responses were placed into two categories: trying to improve a flawed system or expanding upon existing success. One teacher recalls the stress of trying to enact change during COVID-19, "I tried really hard to between March and July to work carefully with administrators to try to have a cooperative approach to the pandemic and do everything that we needed to do." By summer, they felt like anything said to administration was "falling on deaf ears." When looking at larger systems, an educator started asking "every question that needed to be asked" and this process of championing change left them disenchanted and it "was essentially the beginning of the end for me."

Another educator experienced success when enacting change surrounding student placements in remedial classes after repeatedly noticing "like, he's way too smart to be in here." The educator became "very adamant … that there's a change that clearly needs to happen" and the district agreed. By working with dual-language families, this participant became passionate about creating systems for newcomers and non-native English speakers to onboard into American schools with proper placement exams and class schedules. This level of advocacy brought a "love for dual language and the families" and a "passion for working and advocating for newcomers." A different teacher desired to make large scale changes to the science curriculum by moving away from the memorization of facts to critical thinking. By and large, they describe only a "smallish subset of science educators who don't even get it" and resisted the shift.

One educator felt compelled to champion for the needs of teachers during the pandemic. This participant reports being "silenced" because they asked questions that got leadership anxious. As a union representative, the teacher tried to advocate for ethical use of donor funds when meeting with district leadership, foundation members, and potential

donors by questioning decisions that would "pit member groups against each other, fighting each other over resources." Another felt a "rush of advocacy" after experiencing unsupportive maternity leave practices by their district. This educator wanted to ensure that the school was adhering to regulations surrounding pumping rooms for new mothers. They remember thinking their administration "just didn't seem to know what was going on. And so, I felt like I was getting the run around all of the time." One teacher describes positively advocating for teachers' mental health in order to combat burnout. They highlight the importance of telling colleagues, "Hey, it's okay to take a mental health day, you know, and realizing the importance of that."

When discussing teacher leader roles, building capacity in educational systems is frequently mentioned. One educator explains how they did not have a leader who provided systems of support. They went into administration to be the leader they never had. One teacher highlights the value of building systems of capacity, as a teacher leader, through opportunities like professional learning, facilitation, strategic planning, building site planning, and being a department head. They elaborate that each of these opportunities created the foundation for understanding larger educational systems which compelled them to dive into the world of leadership. Another participant describes the switch from wanting to build capacity in adults rather than students, "I kind of feel like I'm coaching again in a different way. You're doing a little more adult development than just student development." One teacher shares how in their new role as a leader, they get to disarm situations and create solutions for both parents and teachers through creative system approaches. They continue that as an administrator they "reevaluate, create new systems, and try to make processes easier and more "student friendly." Another teacher,

turned administrator, elaborates, "I can see that impact scope, and the lens gets larger when I'm helping out teachers. So that drives me now."

In summary of teacher qualifications and leadership aspirations, the ten participants who had a desire to lead and to be professionally developed all highlighted making a larger impact, instituting necessary change, and feelings of accomplishment when ideas are implemented. Many of these mid-career STEM educators found value in leadership roles because it stretched them professionally and created new challenges. Conversely, some of these same educators spoke to leadership aspirations that fell flat, leaving them disenchanted and deflated with educational systems.

Perception of STEM Career

Of the two hundred and seventy-six comments analyzed, participant responses related to perceptions of STEM teaching career are organized into the subthemes career satisfaction and dissatisfaction. Twelve major and thirteen minor categories surfaced during thematic analysis. These elements are listed in sequential order of highest density in participant responses and code frequency.

Career satisfaction and career dissatisfaction are two sides of the same coin because they both stem from individual perceptions and expectations regarding work. While career satisfaction reflects fulfillment and contentment with one's job, dissatisfaction arises when expectations are unmet or when there's a mismatch between personal values and organizational culture. Both experiences are subjective and influenced by factors such as job role, work environment, and opportunities for growth. Additionally, career satisfaction and dissatisfaction can fluctuate over time, often depending on changes in job circumstances or personal priorities. Ultimately, individuals

may experience both ends of this spectrum throughout their career journey, highlighting the interconnectedness of these two phenomena.

Career Satisfaction. From the one hundred and twenty-three comments related to career satisfaction, the following major categories, in code frequency and density order, are to help, guide, and impact students; to inspire and improve student learning; creativity and innovation in lesson planning; building relationships and connections; a passion to teach and instruct; an accomplishment in building capacity in systems and people; math and science content; and a teacher schedule and routine. The codebook definition for career satisfaction was described as a participant's contentment with their working conditions including their perceptions of value, impact, purpose, and performance.

Help, Guide, and Impact Students. Ten out of eleven participants referenced finding job satisfaction in helping, guiding, and impacting students. With a code frequency of twenty-four, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator found value in developing students and seeing them "use their skills effectively." Another enjoyed helping ESL newcomers transition into the correct math placement because "they just don't have the language capacity to do it for themselves and their families just don't know our system."

One teacher reflected on the power a teacher has in a child's life, "what seems like a daily encounter can really make a difference in a child's life." Another desired to be their student's cheerleader by helping them grow and progress along their path. They describe helping students to "recognize something in themselves that [they] had seen but [the student] didn't see yet." A participant saw the power in changing students'

perspectives, "see the world through a broader lens then their own experiences." A former high school teacher felt impactful helping students navigate the next step because "they're getting close to adults and they're curious about their path." Multiple participants referenced how meaningful it is to have former students come back and tell you how you have "influenced their lives." One elaborated that seeing kids who have made strides behaviorally, "who really struggled to just do school, like, do the act of being a student … come back and go, you impacted by life … it's certainly emotional." Another remembers having family members share how you made a difference in their child's life, "how you've helped their kid and now they are trying for a perfect score on their ACT." Or that feeling of success on graduation day and reflecting on student growth from freshman to senior year and how students have "completely turned things around, like, that was my why," says one teacher. One educator reflects on graduation parties reinforcing the influence they have made on a student's life, "it was just so cool to see the impact."

Inspire and Improve Student Learning. Eight out of eleven participants referenced finding job satisfaction in inspiring and improving student learning. With a code frequency of twenty-three, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher loved getting to work with young learners and inspiring them to reach their highest potential. Another educator did not believe in pushing kids through. They felt passionate about meeting kids where they are, providing the proper supports, and propelling students to the next level so they can succeed. One participant valued "working with the struggling learners and getting them to a point of success." Another delighted in that feeling of

accomplishment with a struggling learner when "they're like, oh, I get it." One described how those "aha moments" made them feel good about themselves. A second teacher enjoyed "that light bulb effect or, you know, that moment when a student grew, learned something new, conquered a challenge." One educator found purpose in "opening students minds to new things." Another strived to unlock the potential in a student by "finding something that challenges them at the right level."

One participant's goal was to help students be better thinkers, "I think the single greatest thing that we can do for thinking literacy is shift people from a binary to a multivariate mindset. That single change makes an unbelievable difference for people." One educator found it fulfilling to see growth in students over time. A participant highlighted how a teacher has the opportunity to course correct a student and inspire them to greatness. They continued "you just never know the trigger moment. You could be the one that helps it click for that child and changes their trajectory for the rest of their life." For another it was just the joy of learning. They elaborated, "when we discovered something together that I didn't realize was gonna happen. And we could just celebrate and have fun and be in amazement with one another." An educator cherished "those moments of celebration and learning, and they don't always come quick and easy."

Creativity and Innovation in Lesson Planning. Seven out of eleven participants referenced finding job satisfaction in creativity and innovation in lesson planning. With a code frequency of nineteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One participant felt driven each year to create and innovate because it made the job fun and meaningful, and they did not want to be the teacher that always did a "rinse and repeat." Another expressed, "I

loved the planning and organizing aspects of teaching." One teacher liked teasing out all

the details and making engaging lessons. A science teacher's fondest memories were

finding new resources, trying new things, meeting the unique needs of students, and

making those connections between innovative ideas and curricular content. One educator

found the best learning experiences did not come "from a robot." Their goal was to have

students learn "outside of the box a little bit" with guidance from an expert. A different

educator valued the freedom to create without any micromanagement. They wanted

autonomy because "that's where exceptional teaching happens … that zone of creativity

and invention using non-traditional teaching methods." One described success as creating

innovative lessons that match what is happening in the scientific community and getting

to embed real-world scenarios. A participant states, "what drove me was how can I make

this just a little bit more relevant and fun for them. And when that was really clicking

between the planning piece and seeing it live and kids enjoying it." An educator loved

creating a lesson that gets all the students completely hooked. Another teacher

experienced satisfaction in "seeing the hard work of planning a lesson pay off. All the

perfecting and going the extra mile turning into a lesson with great energy, making

students engaged and motivated."

   Building Relationships and Connections. Eight out of eleven participants

referenced finding job satisfaction in building relationships and connections. With a code

frequency of sixteen, participant responses have been pared down to the following

quotes, paraphrases, and summaries capturing the key ideas. For many participants, job

satisfaction came from connecting with kids and building relationships. One said it was

all about "those relationship building moments. I felt like I was making an impact."

Another teacher smiled, "young people give me life, keep me young, I find them interesting, and enjoy mentoring them." One educator loved learning about kids experiences and life. They elaborated, everyone has walked a different path, and "I just learned so much about the world from [my students] and I learned so many different perspectives and lifestyles and backgrounds." Another stated, "I loved the kids. They were tough kids who hated school … I could really relate to them. I was not good at school. I did not like school." A theme amongst participants was it's all about the connection and helping people grow. One former teacher reflected, "good connections are hard to find outside of education."

A Passion to Instruct and Teach. Five out of eleven participants referenced finding job satisfaction in instructing and teaching. With a code frequency of thirteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Many participants emphasized the enthusiasm and energy that teaching brings. One educator portrays a great lesson, "like living in a lesson … when it's rolling and you're like, okay, I got this down. And kids are responding to it, and they're engaged and you're just in the middle of those fun lessons. That's what I live for." Another's favorite days happened when they were with students "just having fun doing science all day. And it was so great, and the kid would get super into it ... I don't get that anymore, and I miss that." A teacher echoes that they miss bringing the content to life. Other educators miss creating engaging lessons that had students on the edge of their seats. One teacher relayed, "the kids' reactions and expressions. It's contagious and addicting, those are great instructional days." A participant fondly remembers, "to teach a lesson from beginning to end, there's something fulfilling about that. I do miss it quite

frequently." One content expert enjoyed the ability to lean into their passions when teaching and igniting that same excitement in students. One teacher summarizes, "just overarching wise, broad scope, it was seeing kids enjoying their time learning math." Another educator concluded, teaching always felt more like a passion, not a job. Teaching "filled my bucket."

  Accomplishment in Building Capacity in Systems and People. Five out of eleven participants referenced finding job satisfaction in the accomplishment of building capacity in systems and people. With a code frequency of twelve, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher experienced accomplishment when collaborating with colleagues and creating a phenomenal project advanced science instruction for the district. A participant felt accomplished when influencing colleagues to implement research based instructional practices. Another describes feelings of purpose surrounding the development of a "launch project" associated with expanding professional development opportunities for teachers, by reducing barriers in teacher collaboration. One person noticed that there was not clear guidance on a course, so they worked with the district to create the necessary class curriculum with teacher support. Other participants reference foundational discussions surrounding instituting in change. Though these large-scale projects, participants found purpose and value in bolstering the field of education through sharing their voice, time, and talents.

  Content. Five out of eleven participants referenced finding job satisfaction in the mathematics or science content. With a code frequency of ten, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key

ideas. One participant stated getting to teach something I loved "just triggered my own curiosity in terms of what I do for work." One educator's goal was to create positive memories surrounding mathematics by making the content enjoyable, relevant, and fun. Another teacher relays, it is awesome getting students excited about science, "I really miss the days where it's just like a complete investment in exploring some new scientific thing." Another participant strived to provide students with cutting edge instruction by exposing students to scientific modeling that was relevant and real-world. An educator loved getting kids interested in the content, "it felt so amazing those days … you're just having fun doing science all day. And it was great. And then kids would get super into it."

Teacher Schedule and Routine. Three out of eleven participants referenced finding job satisfaction in the teacher schedule and daily routines. With a code frequency of six, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Multiple participants liked the routine that teaching brought to their life. One educator expanded, there are positives and negatives to having the set teacher schedule, a major positive being how much is accomplished by 9:00 a.m. Another conveyed, "one bonus to a teacher schedule is having the same breaks as your kids." Beyond the daily teacher schedule, numerous participants appreciated the fresh start of the teacher schedule. One teacher described, the "beauty of it, we have a schedule where you get to start fresh every year, and you get to close a year. There is something really healing and wonderful about that process."

Career Dissatisfaction. Out of one hundred and fifty-three comments, the following major categories for career dissatisfaction surfaced, in code frequency and

density order, lack of accomplishment, work-life balance, burn out, and autonomy in decision making. The codebook definition used for career dissatisfaction was a participant's discontentment with their working conditions including their perceptions of value, impact, purpose, and performance.

Lack of Accomplishment. Eleven out of eleven participants referenced experiencing a lack of accomplishment, with a code frequency of thirty-three. Within the category lack of accomplishment three minor categories appeared: lack of accomplishment with students, lack of accomplishment in job performance, and lack of accomplishment in ability to change systems.

Ten out of eleven participants reference having job dissatisfaction due to a lack of accomplishment with students. With a code frequency of twenty, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator describes dissatisfaction "when you just have those kids who absolutely refused, for whatever reason, to even let you help, like they were just not receptive. And knowing my own nature to help people … to have kids who absolutely refuse was tough." A second teacher had a similar stance of struggling with students who "just don't bring anything to the table." They elaborated that students have no discourse, seemed disengaged, and unmotivated to learn. The educator did not feel effective at their job anymore and stated, "I'm like this is not for me anymore." One participant explained that students were not responding to their teaching as much as they did at the start of their career. Another teacher divulged that it started to feel like it did not matter if they were there or not. Early in the educator's career, they believed they made a real impact on students and the school, and by the end, they felt replaceable.

One person observed a lack of accomplishment with students due to competing with phones and technology. They clarified how kids are always dialed into their phone and it's extremely hard to reach them, to motivate or engage them. A different participant expounded on how it is difficult to feel effective when teaching thirty students in a class. They state it would be next to impossible for "even an expert teacher to get every single one of the students" engaged. One more teacher said, "having a class size of 32 students multiple times a day was not lending itself to effective teaching." This sentiment was expanded upon by another participant who conveys the turmoil of teaching a class full of twenty-eight kids when one student is having a difficult time. They could not do their job in the manner they wanted, and struggled knowing a student was going through a hardship and needed more attention than the participant could provide. An additional participant described how large class sizes made it tough to feel accomplished because you are always missing a connection with kids, which creates a "horrible feeling." One teacher detailed missing the mark with the middle of the road kids. They explained how the high performing students took all their attention and energy. The go-getters will be seen because they ask questions, because they are highly engaged learners by nature. They continue, "I just keep missing them completely," referring to the middle of the road kids, which is a majority of the class. And "it's frustrating putting forth all this time and energy and missing the mark with the masses in your classes." And another echoed, "I didn't feel like I was making a difference. I didn't see growth."

One educator shared that the continuous disciplining of students was defeating and unrelenting. This participant was no longer seeing the impact of coaching positive behaviors anymore, because there was no improvement. Another teacher referenced how

teaming changed within the building. They did not have the opportunity to work collaboratively with colleagues to address student academic and behavioral concerns anymore. They noticed student's needs were not being met like they previously had been, and remarked, "it's just defeating for me." In a similar vein, an educator expressed a lack of accomplishment in being able to address life skills, such as cheating, homework completion, and effort due administration response. An additional teacher catalogs having a lack of accomplishment with students because there was never follow through or consequences for when students completed assignments or not, behaved or misbehaved, "nothing is happening at home for many of these students. And so, I think just that, over time, seeing kids overall care less and less and less and less." Lastly, when returning to school after COVID-19, an educator did not feel accomplished in addressing all the students needs in both a remote and in-person environment, "I'm not giving the highest quality education that I can for both these in-class and these remote students, especially the remote students."

Five out of eleven participants reference having job dissatisfaction due to a lack of accomplishment in job performance. With a code frequency of nine, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher describes a lack of accomplishment when lesson plans do not go as intended because there is a curveball in how students respond. They specified that when something "you didn't anticipate" materializes in class and you "need to change course completely" it can be very defeating. Another participant felt a lack of accomplishment when the necessary tasks were not completed for the next day, week, or unit, "there is always 10 things I didn't get to that day that had to be done." They

elaborated that having the continued feeling of maybe not making a deadline made them incredibly stressed out because the workload felt like too much. An additional educator expressed "bad feelings about technology" overuse with students being 1:1 and the ever-changing landscape of technology.

One teacher experienced a lack of accomplishment because the community did not see the strides in their classroom when standardized test scores were published in the paper, "it's difficult to swallow, you know, when the public is looking at it, and your test scores are low." This educator did not like being compared to other districts or classrooms because it had a deflating effect. A different teacher stated they did not feel a sense of accomplishment in the same manner in which they were being evaluated. They elaborated that standardized test scores did not bring about accomplishment and only created a misalignment between the values of the district and their personal philosophy on education. Another did not see the purpose anymore. They felt like their efforts did not move the needle anymore, "It was frustrating that all this work is going into something that eventually doesn't matter and that's where, in my mind, I'm like, this doesn't matter anymore. I used to think it really mattered … it doesn't matter." One person claimed their intrinsic motivation started going away, "what am I doing this for?"

Three out of eleven participants reference having job dissatisfaction due to a lack of accomplishment and feeling powerless to change circumstances. With a code frequency of four, participant responses have been pared down to the following quotes, phrases, and summaries capturing key ideas. An educator outlines being powerless when their unique contributions to instruction were being stripped away with strictly scripted curriculum and course guides. Another teacher felt powerless in decision-making

surrounding the school, their classroom, students struggling emotionally, and with complex family dynamic issues. The last person experienced a lack of control over situations happening in the building and did not see how they could make things better; they could "no longer see a viable solution to fix things."

Burnout. Nine out of eleven participants reference burn out, with a code frequency of forty-nine. Within the major category burnout four minor categories appeared, in order of frequency, health, feelings, relationships, and general burnout.

Seven out of eleven participants reference having physical or mental health concerns due to burnout. With a code frequency of seventeen, participant responses have been pared down to the following quotes, phrases, and summaries capturing key ideas. One teacher could not escape all of the stress, because work was on their mind all the time, and they didn't feel like they could take a full breath or live a full life. Another said, "I mean, it was really my mental health and my physical health … I put on a lot of weight, and I think that's when, it's really like okay, I can't do this anymore. Like, this is not working. I need a change." Feeling burnt out and overwhelmed, an educator had a conversation with their administrator, "I'm trying to tell you everything put on my plate. I'm coming to you struggling right now. And I want your advice as someone who's been around a lot longer than me. And he just wouldn't say anything." A different participant explains how experiences at the end of their career "just crushed me" and it took "continued reflection, friends, counseling, a career change, and time. I'm, I would say, 97% recovered but there will be some level of recovery that will never be possible whatsoever."

After COVID-19, a teacher recounts, "we were all not in a good head space."

Coming back and teaching after COVID-19, was more than one educator could handle. They detail, it was not COVID-19, it was the stress of contact tracing students; constant reminders to put on their masks; remote and in-person lesson preparation and teaching, "my psyche, for me, you know, just emotionally, mentally, this is something that I can't handle for much longer." A second participant said, "I believe in my heart of hearts that my mental health was, I was, discriminated against by my school district." It has been difficult for this teacher to reconcile the toxic work environment of being "emotionally and psychologically abused by people who are supposed to be leaders." An educator who is still connected to schools observes, teachers are still exhausted, "it is so admirable how hard they're working despite how tired they are."

Six out of eleven participants reference having feelings associated with burnout. With a code frequency of sixteen, participant responses have been pared down to the following quotes, phrases, and summaries capturing key ideas. For one participant, being overwhelmed manifested as feeling like no matter how much they did, they could not get ahead. Another said their burnout happened as a long string of events over the years, "like it wasn't just COVID-19, it wasn't." One spoke of unrelenting stress. One catalogs the unobtainable expectations placed on them and feeling overloaded, overwhelmed, and debilitating stress. While a different teacher conveys their burnout as, "I started to feel apathetic and like, whatever, do it or don't do it. I don't care." Losing their why of teaching is what made burnout the hardest for an educator, "those … intrinsic good feelings started going away." One person tells, "I'm maxed out over here and then I started, I think, if I'm going to be completely honest, I think I started feeling resentful." Another teacher depicts decision fatigue, "you know, I'm still making decisions [in my

new job], but I'm not making hundreds to thousands of mini decisions every day."

"Nagging anxiety," is how a participant explained their feelings about work on nights and weekends. One person describes their burnout and ultimate decision to leave, "I'm stressed out, it's time to step away because then I'm just gonna start hating my career. And I don't dislike it. I like it. I love it. I miss it. So that's kinda like what it came down to." An educator claims since leaving teaching, "I don't have that full-time stress. So, I'm just, I'm a much calmer person. I feel like I'm a lot happier. I've never been so laid back."

Five out of eleven participants reference having a change in personal relationships due to burnout. With a code frequency of nine, participant responses have been pared down to the following quotes, phrases, and summaries capturing key ideas. One participant did not have a plan when leaving education, they just knew they needed to get out because it was taking a toll on them and their family. A teacher could sense a change in their attitude, "I was getting bitter by the time I decided to not be teaching. I was like, this is not turning me into a very nice person to be around, so I need to take a break." Another educator expressed, "My marriage! Like, I was so unpleasant to be around like [my husband] told me after I quit, he's like, yeah, there were days I didn't think we should have gotten married. It's like you were always unhappy and crabby." The significant other of a different participant encouraged them to leave the profession saying, "I just want you to breathe. I want you to be able to just focus on just one thing, like you have too much in your basket." A third teacher's spouse said, "you're not happy in your job anymore. It doesn't bring you this excitement. You're not mad, but like, you're not happy a lot of the time." Changing dynamics on how they viewed themselves

at work is what impacted an educator's decision to leave,

> I remember one year we did Gallup, we talked so much about Gallup's strengths,
> there was this graphic of people actively engaged to then all the way down people
> actively disengaged. And I remember my administrator presenting it like, the
> actively disengaged, like these are the people that are actively trying to sink our
> ship. And, I wasn't there, but I was the one before it, like, these people are
> deadweight. They're just dragging along. They're not actively doing anything,
> and I felt like, if I get there, like, it's time to go, and I feel like I was getting there.
> And I got to the point where I'm like, I don't know that I would want my kids to
> have me as a teacher. I'm at that level of not giving a crap.

Four out of eleven participants reference having general burnout. With a code frequency of seven, participant responses have been pared down to the following summary capturing two key ideas. One educator explained that their burnout was a pile on of multiple terribly negative experiences as a teacher. Another stated that they just could not do it anymore because they had reached a breaking point.

Work-Life Balance. Ten out of eleven participants reference work-life balance, with a code frequency of forty-five. Within the major category work-life balance three minor categories appeared: inability to balance work overflow, family obligations, and comparison with current job.

Ten out of eleven participants reference having job dissatisfaction due to work-life balance and an inability to reduce work overflow. With a code frequency of twenty-three, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. A teacher depicted how weekends and evenings

felt like extended work times, and not an opportunity to recharge and get rejuvenated, leaving personal tasks incomplete. To make extra money, a teacher worked the afterschool program at school, "It was basically a part-time job but I'm at school until 7:30 pm … like, is this what I want to do with my time?" Another spoke to not adequately allocating time to both work and family, "In my personal life, that's where I was taking the time from to keep the balance professionally going. I was working a lot of late nights and early mornings to be able to compensate." An educator reports that work-life balance continued to decline, especially with the substitute shortage, and needing to cover teachers' classrooms with absolutely no time to complete work tasks during the working day which forced the teacher to work late nights and weekends.

One participant highlighted the imbalance in life causing everything to fall short: their work, family, and personal well-being. When reflecting on the overwhelming anxiety surrounding balancing work and family, the educator remembers, "The early mornings, getting the kids out of the house … coming home and only having 20 minutes to turn around and do the next thing, that constant day in and day out … I don't know how I survived." A person described teaching as "very emotionally taxing. Then you'd come home and not have a lot for your family." A different educator sees teaching as a calling and yet they had to step away, "I feel like I had to put that passion aside. In order to better myself and in order to be a better person to my family." One teacher recounts a conversation with colleagues related to family obligations, "They're feeling guilty prioritizing their children or their families or some aspect of their life … which they shouldn't be feeling guilty in any way, shape, or form." Resentful is how one participant started to feel about the imbalance between work and life, "I'm not doing the things I

thought I was going to do when I'm a mom. Then, suddenly I sort of realized I'm not doing these things because I'm maxed out [from work]." This is ultimately what came into play when the teacher decided to leave the classroom. Another educator shared,

> That's not in the makeup of a teacher, you know, because we're part of that caring and service. Like we want to do that for our families and then we're like missing the mark. A ton of teachers are feeling like they're not getting that at home and work, you know it feels like it just kinda gets brushed under the rug.

Five out of eleven participants reference having job dissatisfaction due to work-life balance and juggling a new baby. With a code frequency of fifteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One of the five participants chronicle the difficulties of having a new baby and teaching, they explain that a work-life balance seemed impossible during maternity leave and in those first few months returning to work. They reference working over maternity leave, even grading student papers, because the substitute could not. Then, returning to work and needing to pump had its own obstacles for a participant, who found the inflexibility of a teacher's day difficult to schedule pumping sessions around teaching. Another shares that staying at school until 6:00 p.m. most nights were fine before kids; however, "Once my first son came, the first thing I wanted to do when the bell rang was leave. But I didn't have [necessary tasks] done, yet … he's been at daycare all day, like it's not fair." A different teacher had a similar experience, "When I had my son, which was when I realized how kind of off-balance my work-life balance was, I was consistently working at home, and all the things weren't feasible." A growing family changed another educator's perspective on work, "When I started to have a family of my

own, I could not believe the hardship that I felt in terms of that and teaching, so it got to the point where it kind of became overwhelming for me."

Three out of eleven participants reference having better work-life balance in their new job. With a code frequency of seven, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. In their new position, a participant chronicles their workday, "I show up to work at 7 am. And I work really hard from seven until about four. And then I leave at 4 pm and go home and I don't work. Saturday and Sunday, I don't work." Another former teacher highlights getting to be more present with their kids now because they have the opportunity to volunteer at their kids' school, drive kids to practices, and get involved in the community again. One former educator agrees because now "I have more time. Time is always tough when you have young children, but I get to coach my kids… take them to activities … school … I wasn't getting that before." They continue that their new job provides the best work-life balance with unlimited time off which makes it easier with sick kids and scheduling appointments.

Autonomy and Decision-Making. Nine out of eleven participants reference autonomy and decision-making, with a code frequency of twenty-six. Within the major category autonomy and decision-making three subcodes appeared (not in code frequency order): had autonomy, lost autonomy, and want autonomy back.

Three out of eleven participants reference having previously had autonomy. With a code frequency of eight, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Most of their career, an educator felt they were "given the freedom to effectively do whatever [they] wanted from

a curriculum design standpoint because [they were] trusted." Their colleagues understood how seriously they took crafting beautifully designed lessons. Another stated that when collaborating with colleagues, they had the "permission to play," and with this freedom they created cutting edge courses for the district. One educator enjoyed their time teaching at an alternative school because, although they had a set curriculum, the district gave them the autonomy to do more of what they wanted to implement the curriculum. They did not need to stick to the strict district-mandated curriculum and follow the same guidelines as others. They appreciated that "the administration gave [them] a lot of room and a lot of resources."

Four out of eleven participants reference losing autonomy. With a code density of twelve, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator explains that the loss of autonomy and decision making has made teaching feel like "a monkey could sit in there and do some of those things" which takes the artisanship and creativity out of teaching which is motivating and rewarding to teachers. A teacher shared,

> Having to teach specific things at specific times really irritated me. I will say that was another big one, that is, for me to get out of the classroom. Because that's not what was fun to me at all. What was fun was coming up with new things and adjusting as needed for the students and taking some of their interests and ideas and doing things with it.

The loss of autonomy feels like distrust to a participant, "you don't need to be hovering over the top of me to get my job done … and being treated like an adult." One person feels like the news depicts a story that society needs to "tell teachers what they

can teach, and like, no you don't … And, then that teachers are going rogue, again, no we're not." Another educator noticed parents overreaching into classrooms and telling them how to do their job. They found it insulting to have non-experts influencing how they teach.

Five out of eleven participants reference wanting autonomy back. With a code frequency of six, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Having autonomy back is a determining factor in an educator's choice return to the classroom, "to be frank, I would want to be left alone, to my own devices, to do what I do best in the classroom. To trust me." One teacher stated that they would not return to the classroom because things are too "prescriptive now" in lessons and they would not enjoy that. Which coincides with another's response of only returning to teaching if they had more autonomy and decision-making. Another participant desires to "have full control of the classroom" again. An additional teacher shares that in their new job they "have a lot more control" and this brings satisfaction and efficiency for them.

In closure, a STEM teacher's perception of their career can be placed on opposite sides of the same coin, career satisfaction and career dissatisfaction. Case study comments indicate that STEM teachers find immense career satisfaction in their ability to positively impact students through inspiring and improving learning outcomes. Building meaningful relationships with students fosters a sense of fulfillment, while the opportunity to be creative and innovative within the curriculum keeps them engaged and passionate about teaching. The sense of accomplishment derived from seeing students succeed, coupled with an enjoyment of STEM subjects, reinforces their dedication.

Additionally, the structured schedule and routine inherent in teaching provide stability and balance to their professional lives. STEM teachers with greater career satisfaction comments than dissatisfaction tended to leave the classroom for leadership roles within their district. Conversely, the STEM teachers with more mention of career dissatisfaction took positions outside of school districts, and many of their positions still had an association with educational systems. Many STEM teachers experience a sense of dissatisfaction due to a perceived lack of accomplishment, such as when students struggle to grasp complex concepts despite their efforts. Work-life balance can be elusive for STEM educators who find themselves constantly juggling lesson planning, grading, and additional job requirements, leaving little time for personal pursuits or relaxation. Burnout is a common concern among STEM teachers, exemplified by feelings of exhaustion, cynicism, and a reduced sense of efficacy, often stemming from heavy workloads and high expectations. The absence of autonomy in decision-making, like being constrained by rigid curriculum guidelines or administrative directives, can diminish a teacher's sense of professional fulfillment, and hinder their ability to innovate in the classroom.

Participants Perception of Local Building

Participant responses related to their local building are organized into the main themes of local building demographics, internal building systems, and building working conditions. Subthemes and categories surfaced during thematic analysis. These categories are listed in sequential order of highest density in participant responses and code frequency. Local building responses are organized into main themes, subthemes, major

categories, and minor categories. Figure 5 is a visual depiction of former STEM teachers'

responses related to attrition factors within their building. The number of participants

referencing a factor of attrition along with the amount of times it is mentioned provides

context to reasons for attrition; however, the explanation is best portrayed through the

individual narratives of participants.

Figure 5

Building STEM Teacher Attrition Response Themes

Minor Category

Grow Staff
(n = 55%, comments = 9)

Feedback and Observations
(n = 27%, comments = 6)

Hold Staff Accountable
(n = 27%, comments = 5)

Major Categories

Teacher Growth and Development
(n = 73%, comments = 20)

Address Student and Parent Concerns
(n = 55%, comments = 11)

Visibility and Support
(n = 55%, comments = 11)

Mentorship Impact
(n = 82%, comments = 16)

Formal and Informal Mentorship
(n = 45%, comments = 15)

Positive Mentor Qualities
(n = 36%, comments = 8)

Needing More Plan Time
(n = 55%, comments = 9)

Use of Plan Time
(n = 45%, comments = 7)

Number of Class Preparations with One Plan Time
(n = 27%, comments = 4)

Loss of Plan Time
(n = 27%, comments = 4)

Administrative Support and Response
(n = 36%, comments = 5)

Proactive
(n = 27%, comments = 3)

Tiers of Support and Intervention
(n = 27%, comments = 3)

Lack of Consequence
(n = 18%, comments = 2)

Student Discipline Impact on Learning
(n = 9%, comments = 3)

Professional Growth
(n = 45%, comments = 9)

Instituting Change
(n = 27%, comments = 7)

Suburban
(n = 91%, comments = 13)

Rural
(n = 18%, comments = 21)

Urban
(n = 9%, comments = 5)

Subtheme

Administrator Tasks of Leadership
(n = 91%, comments = 42)

Mentoring
(n = 91%, comments = 39)

Plan Time
(n = 82%, comments = 24)

Student Discipline
(n = 73%, comments = 16)

Professional Learning Communities
(n = 45%, comments = 16)

Location
(n = 100%, comments = 39)

Level:
Middle School and High School
(n = 100%, comments = 9)

Title 1, Poverty Rates, Free and Reduced Lunch
(n = 36%, comments = 6)

Main Theme

Internal Building Systems

Building Demographics

Note. N=11. Subthemes, major categories, and minor categories are organized from highest density in participant response and highest frequency in comments. Colors are to designate between main themes.

Building Working Conditions

Building working conditions can vary based upon year, staff, administration, and various other external factors. Building working conditions are more fluid while building systems are more fixed. The following major categories for building working conditions, in code frequency and density order, administrator dispositions, workload, student

behavior, school climate, colleague relationships, leadership opportunities and voice, and parental support.

Workload. Ten out of eleven participants reference workload, with a code frequency of forty-three. Within the subtheme work-life balance three major categories appeared: inability to balance work overflow, family obligations, and comparison with current job. The codebook definition for workload includes the written job requirements or unwritten performance expectations placed on participants.

General Amount of Work. Seven out of eleven participants reference their general amount of work. With a code frequency of sixteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Teaching and being with students did not create stress or overwhelming feelings; however, the workload that ensures success when teaching is what got to many participants. One teacher conveys, "it was just kind of the behind-the-scenes" part of teaching that made the workload difficult to manage. Another educator describes their workload bleeding into evenings and Saturdays, "I would frequently grade or lesson plan for 6 hours on a Saturday." Other teachers' reference being underwater and "drowning" in the workload, feeling consistently behind, and "I was constantly bringing work home." There was not enough time in the day to complete the necessary tasks that surround being an effective teacher. One person explained that communicating with parents can easily consume their entire plan period leaving all other necessary tasks to be completed outside of contract hours. Another details that "no one understands the workload unless you have taught before." They exclaimed, "It was a lot. It was a lot for 10 months out of the year. More so than people recognize, I'm sure, if you're not a teacher."

Unrealistic Expectations for STEM Teachers. Four out of eleven teachers reference experiencing unrealistic workload expectations placed on STEM teachers. With a code frequency of eight, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Some teachers use their study hall to get caught up on the work tasks associated with teaching; however, both math and science teachers mentioned how their study halls consisted of helping students. They needed to review concepts and catch-up with students who missed work. These educators described a content area that requires more remediation than other contents, meaning the teacher could not do tasks like responding to parent emails or preparing for the next day during study hall like non-STEM teachers. Another participant found the workload isolating. They clarified that they spent a majority of the day surrounded by kids; however, when it came time to do the difficult work "there were times when I was like, I'm all on my own, I'm on an island" struggling with tasks before me. One teacher expounded on the aspects of STEM teaching, "To properly do the work of planning, preparing stations/labs, analyze student performance, and use data to inform instruction, you just don't get the time do that, but it's expected." Another educator found that the workload is unrealistic because of the unwritten expectations placed on teachers,

> Teachers feel like there's a lot of unwritten expectations, which I've learned some
> leaders are very good at doing. Of like, I can't actually say it, I can't put it in
> words, but you know, and there's those unwritten expectations that we need to do
> XYZ, and teachers just feel overwhelmed by all the things they have to do.

Factors that Impact Teacher Workload. Seven out of eleven participants specifically cite factors that impact the STEM teacher workload. With a code frequency

of nineteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Participants referenced two changes that increased their workload, taking on leadership tasks and increasing class sizes. Two participants found that teacher leader responsibilities significantly added to their teacher workload. One educator said taking on extra leadership roles within the district meant a significant increase in my workload. The teacher described being pulled in multiple directions in regard to "creating content" for the classroom and "researching information" for district projects. It was not sustainable to be a teacher leader. The other person felt used "doing extra things" for the district. They elaborated that the compensation for taking on additional tasks did not match their hourly rate, and the tasks were cumbersome and time consuming.

Multiple teachers referenced class sizes impacting their workload. One educator experienced a lot of work stress, "I think it just comes down to big classes … you know, and so that workload just became overwhelming." One participant's issue with increasing class sizes was rooted in more work, less time, and no change in pay. They explained how working conditions kept shifting as class sizes grew each year, yet the increased expectations did not result in additional support or pay. While a different person detailed how large classes made it difficult to help all the students, "if I have an honors course, I could have forty of those students. But if I have a room full of students who are struggling with math, who are behind in math, ten is plenty." They elaborated that with the amount of work needed to personalize and differentiate content for a large class, "it is impossible to have the time to do it right." A veteran educator explained how their workload and class sizes became too big to manage, as they compared class sizes over the

years,

> I had 20 chairs and I remember specifically they added 2 more kids, and I was
>
> like, oh no, I'm out of chairs" and the last few years before I left "our classes
>
> were capped at 32 and it was full! It was rare to have 32 kids, there for sure were
>
> 30 kids in every single class. And they're big, I mean, they're high school kids.
>
> They're big people."

Student Behavior. Ten out of eleven participants reference student behavior, with a code frequency of thirty-seven. Within the subtheme student behavior, six major categories appeared: classroom manageable/unmanageable behaviors, teacher impact on student behavior, teacher's emotional response to behavior, apathic student behavior, technology, and continued behaviors. The codebook definition for student behavior was a participants' perceptions of how students conducted themselves during direct instruction and unstructured times during the school day.

Manageable and/or Unmanageable Classroom Behaviors. Eight out of eleven participants reference having manageable and/or unmanageable classroom behaviors. With a code frequency of thirteen, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. One educator perceived classroom behavior as manageable, "if you did the discipline, the lunch detentions, …the phone calls, and the emails home, like that all worked for the most part." For one teacher, behavior management improved over time as they witnessed large growth between their beginning years and before leaving the classroom, "there were days that were very hard in my first year and were easy by my [last] year." Another person felt like behavior was never a big concern, "I've never honestly had any problems dealing with students. I've

been very fortunate to always have really good groups of kids. Maybe they feel safe in my room or something." They expanded their teacher education program properly prepared them with classroom management techniques. This participant took their professor's advice of "never yell, get on the student's level, give them choices, send them to the counseling office if they are struggling, and treat each student like an individual," really worked for them. Also, the teacher worked hard at the start of each semester to create relationships with students. They highlighted that relationships are key, because "I'm not super tall or imposing so I couldn't use size to get students to listen, I had to use my personality."

Not all teachers viewed classroom behaviors as manageable, nor did they express being adequately prepared for the realities in the classroom. One participant described how student teaching does not provide enough classroom management coaching because "it's already been established by an expert classroom teacher … these boundaries are already there … [the student teacher] just has to reinforce them." They clarify that when they "went through teacher prep, it was never something that was talked about much. And that classroom management is just huge" and so important for a teacher's success. Another educator referenced struggling with classroom management and how difficult this made their job. A different person expressed how hard it was to deal with "the kids who refused to do anything." Disenchanted with behavior, one participant found it hard to keep teaching with declining student behavior each year, these students have become "horrible and don't listen to you." An educator endured an overwhelming stress from student behaviors; however, they stated that good kids were more likely to keep them teaching, than tough students to push them out. "I had kids that were difficult, but I don't

think that the difficult kids truly were the ones that drove me away. I think it was the good kids that kept me more than any hard kid would've ever drove me away."

   A Teacher's Ability to Make an Impact Based on Student Behavior. Four out of eleven participants reference a teacher's ability to make an impact based on student behavior. With a code frequency of five, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. In regard to impact, one participant recognized the challenge of reaching all students in a class, and how frequently the middle of the road kids are overlooked. In regard to impact, one teacher recognized the challenge of reaching all students in a class, and how frequently the middle of the road kids was overlooked. They explain that it is easy to spend the day responding to kids who advocate for their needs and ask questions or notice the kids with behavior issues. Yet, then the educator did not feel like they impacted the kids with quiet behaviors, who may or may not even be working. Another person states, "A part of me felt bad for the other students who were doing very well and were very well behaved, because so much of my attention, my energy is going to this other [difficult] student … I just felt sad." A different educator struggled with having "kids in all different places," that all need different things from you as the teacher, and it's hard to make an impact for each kid. And the stress that comes with trying so hard, because the teacher just "never knew" when that point of impact would happen.

   Emotional Response to Student Behavior. Four out of eleven participants reference having an emotional response to student behavior. With a code frequency of five participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. A participant tells how the most difficult students had

a story, and likely experienced big struggles outside of the classroom. As an "empathetic person," they found it draining to try and teach a class full of kids knowing that one student was "having a really rough day and showing it." These were the most stressful days for this participant. Another participant went into education to help kids and "to have kids who absolutely refuse was tough" and unfulfilling. A different participant found it frustrating to not be able to educate all students in the classroom because "20% or less of students are taking up 90% of your work energy." One participant recounted being "in a safe room with a kid that's having a very emotional, difficult time" found that the experience informed future interactions with kids, "I think it has opened my eyes to you just gotta take students where they're at and help them."

Apathic Student Behaviors. Two out of eleven participants reference apathic student behaviors. With a code frequency of six, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. One educator observed, "I would say in the last five to eight years, kids are actually very quiet …there's not a lot of shenanigans," and with that, kids are exceedingly difficult to engage. Another echoed student just does not respond like they used to. An additional teacher shared that there has been a steady decline in student apathy, "every year there were just a few more students that just didn't care about school." A different person stated that as years went on, student behavior did not get worse, they just became apathetic. No matter what the teacher did or did not do, the students did not seem to care. The teacher found apathic students to be deflating. Another educator describes a lack of response from students whether it be when trying to engage them or correct behavior, they would just look away, "you are going through something, you're thirteen, and you have all your feelings. I can

let you yell at me, and you're going to have a consequence, but I can't have you give me nothing and that was the challenge."

Technology Impacting Student Behavior. Two out of eleven participants reference technology impacting student behavior. With a code density of five, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. One teacher expresses a dislike for student use of technology, phones, and computers, due to the constant distraction, it "really causes me stress … this feels kind of yucky to use it so much … but is this just a necessary evil of the world we live in now?" Another educator expounds, "the dopamine response that [students] get from these little games and … coming down from that … trying to get them to do something that isn't going to give them a dopamine hit … they don't want to listen." And "aside from the distraction, the fallout of just being able to be recorded at any point, at any time, any portion of what you're saying," and even though this person does not believe that most teachers are saying anything that could get them in trouble, "it's just this new thing and that's terrifying." Another finds that students need more education on healthy uses for technology, and teachers need more support systems to manage student phone and computer use in class because current methods are not working. A participant chronicled how technology has changed student behavior over time. Early in their career, engagement was high for students and behavior was low with "talking across the room, getting up and walking around, outbursts … just normal kid stuff," and now with the addition of phones, "I mean, the minute there is any ounce of free time, it's straight to a device" so students never really engage or misbehave anymore.

Continuous Student Behaviors. Two out of eleven participants reference needing

to continuously deal with student behaviors. With a code frequency of three, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. A participant describes "the kids that would just push and push and push and just would not listen. And it would take a lot for me to just stay calm and consistent … about their behavior and trying to redirect them or whatever." Another participant found "the continuous discipline" to be exhausting and will not return to teaching because of it. This participant elaborated that in their new job, "I don't have to worry about other people's behaviors all day" and every day.

Colleague Relationships. Ten out of eleven participants reference colleague relationships, with a code frequency of twenty-eight. Within the subtheme colleague relationships three major categories appeared: having a friend at work; feeling supported and valued by colleagues; and collaboration and teambuilding. The codebook definition was a participant's perception of how staff members engage within the building, specifically looking at finding value, trust, support, and mutual respect in these interactions.

Having a Friend at Work. Eight out of eleven participants reference having a friend at work when describing colleague relationships. With a code frequency of twelve, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Four participants expressed a sentiment of developing lasting friendships with their former colleagues which they still stay connected with now. Another participant explained that they spent most of their waking hours at work and "wanting to be surrounded by friends, people who feel like family." One participant reflected on colleague relationships being fostered and nurtured at the start of their career

because it was a building expectation that we would gather as a staff to get to know each other. A different participant found value in sharing time with colleague and "setting good relationship trajectories" that laid the foundation for collaborating which supported them during the ups and downs of teaching.

Two participants mentioned how their strong relationships with colleagues made leaving difficult. One teacher expanded, "The colleagues and the principals definitely played a role in me wanting to not leave. I am the luckiest person in the world in terms of the people that I worked with. I have made some amazing friends." Another educator said, since leaving the classroom, "I really miss my colleagues, I miss them quite a bit." A different person recalls that some of their favorite memories from teaching are because of their colleagues, and in their new job "I like my new coworkers, but it's different."

Conversely, not all participants had positive experiences with colleague friendships. One shared that they had strong relationships and connections; however, when they needed real support, "my supposed friends were nowhere to be seen." They continued that it was hard to stick around and work next door to people after something like that happened. They knew they needed a change. While four other participants tell how witnessing their friends at work begin to dwindle, due to high turnover, made it harder and harder to justify staying. One teacher catalog that when they first thought about leaving, they did not because they could not step away from their really close friends. As years passed, and especially on "staff development days and workdays, I was like, I don't know who to sit with, like I don't feel like I fit in with anybody. Like my normal core group isn't there anymore." Another educator described being left behind in the classroom while their colleague friends took new jobs.

Feelings of Support and Value. Seven out of eleven participants reference feelings of support and value when describing colleague relationships. With a code frequency of ten, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Four participants, who found value in supporting colleagues, have now transitioned into administrative roles as either a principal, assistant principal, or curriculum specialist. Their responses included statements about the joy that comes from helping teachers. One educator shared how they liked impacting students in the classroom; yet they felt like when they supported teachers, they made an even bigger impact. Another teacher stated that teaching is not an easy profession and when things got difficult, they found themselves emphasizing the positive and looking for opportunities to improve programming or colleagues work circumstances. This person wanted to support others really took the strain out of a difficult situation, because "helping a colleague is incredibly fulfilling, and to see a colleague improve takes a lot of patience and time, but it is worth it."

While some teachers highlighted assisting colleagues, other educators expressed gratitude for the colleagues that supported them. One person describes working with incredibly positive and supportive colleagues, "everyone is willing to help, support, praise, and lend a hand." Another explains how their colleagues were "a good influence on them" and how much they appreciate "the time people invested" in them. After feeling mistreated by their principal, a teacher recounts how much they appreciated a colleague who witnessed the event and came to offer support.

Not all participants experienced positive colleague support. One educator divulged how colleague relationships can make or break an experience. They expounded,

when colleagues do not support you nor come to your defense, or merely act as bystanders, it can be terrible for the receiver, and leave them disillusioned and in need of a career change. They continued that their colleagues were more concerned with self-protection than doing the right thing. A teacher received recognition for making an impact in the classroom teacher, and then felt like colleagues "hated [them] for being excellent." This educator started to forget "what it was like to feel valued." Another person stated that it's hard to reach out and ask for help, from administration or teacher neighbors, and this was especially true as a new teacher.

    Collaboration and Team Building. Five out of eleven participants reference collaboration and team building when describing colleague relationships. With a code frequency of twelve, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher witnessed a swing in colleague relationships and team building from the start of their career, when team building had been an integral part of their work dynamic, to the end of their career, when these fun activities became less frequent. They explained that people seemed too busy to plan team building activities, and soon the activities that were planned had such low participation that they just stopped happening all together. Another participant chronicles how team building declined when administration made changes to common plan areas in their high school. They expound, with departments no longer intermixed, the dynamic in the building deteriorated, everyone was "secluded from each other." This separation made it so "we stopped doing things and didn't plan stuff." Slowly, "it all just started to go away, and nobody wanted to do anything." This was a big shift from before when "everyone is together all the time, like in the plan area" and it had this community of

support feel about it. Another participant echoed how a reduction in team building created feelings of isolation, which really killed morale.

In regard to collaborative relationships, one teacher found an immense amount of value in their collaborative relationships where they could create goals and make huge progress in revamping curriculum through innovation. They specified that those other colleagues, who were reluctant to change, saw what they were doing, the difference they were making with students, and these colleagues became interested in collaborating too. Another educator actually applied for a position outside of the classroom just so they would not have to continue collaborating with their colleague. They elaborated, "I couldn't take it anymore … I didn't align with their educational philosophy."

School Climate. Eight out of eleven participants reference school climate, with a code frequency of thirty-three. Within the subtheme school climate four major categories appeared (not in frequency order) a need for positive culture, school culture decline overtime, new administration, and cliques/relationships. The codebook definition for school climate was a participant's perception of the school environment and how administration, teachers, students, and parents interact. The school climate includes the participants sense of community, relationships, and building traditions.

Positive School Climate. Five out of eleven participants reference having a positive school climate during their teaching career. With a code frequency of seven, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. One teacher fondly remembers the start of their career in which the building had long standing traditions of departments coming together monthly to plan events, be silly, and have fun. Another educator shares memories of staff members

regularly having the opportunity to meet, share, and dream, and how this time to collaborate as a staff built a strong positive climate. They elaborated how this climate allowed for cross-mentoring, innovation, and risk-taking which ultimately stretched staff professionally. A different teacher felt fortunate to be heard, respected, and supported in their building. One participant spoke about how their buildings' initial positive culture allowed staff to "understand building structures which reduced misinformation, miscommunication, and anxieties with staff."

School Climate Declining Overtime. Five out of eleven participants reference school climate declining overtime. With a code frequency of thirteen, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. One participant chronicled how the building climate was changing in all the wrong ways, "there used to be respect for the administration. There was a community dynamic where people helped each other. And the staff regularly hung out, and people knew each other." They convey that all these building climate characteristics started to disappear. Another educator spoke about the climate shift starting with staff no longer being held accountable. They explained that it was a slow and steady decline that occurred over the span of their career. A different teacher saw climate diminishing with staff turnover, all the "historic building traditions" got lost. According to a participant, building climate is rooted in an engaged staff, and they noticed that as the years went on, less and less people interacted with each other. They continued that staff members stopped volunteering to plan activities making the morale and climate dip. "COVID did not tank building climate, the decline occurred years before when people did not make time for each other," a teacher claimed. They outlined the gradual reduction starting years

before COVID-19 with things like the Halloween social or little treat baskets or positive notes passed between teachers, all dwindling because no one had the time anymore to keep up the momentum. Another educator pointed to their building needing stability, "all the change made it difficult to have a strong climate" and their administrator's solution was more jean days, which they said did not move the climate needle.

A New Administrator Changes the Building's Climate. Two out of eleven participants reference having a new administrator change the building's climate. With a code frequency of six, participant responses have been pared down to the following summaries capturing the key ideas. One participant witnessed the backwards slide happening in the building under new leadership. One teacher witnessed a backwards slide happening when the building was under new leadership. There was a noticeable difference in the progression of skills, processes, and teacher development which once had made the building a pillar of excellence. A second educator stated that administrative changes had altered the historic culture of the building. Their administrator was destroying the characteristics that made the high school unique, in order to make the school more like the principal's former building. Staff did not receive these administrative changes well, and it was the beginning of the participants' personal frustrations with the profession. They felt like the culture had transformed into one in which the administration did not care about the teachers. As time progressed, they noticed the collective community, that was once united to serve and support kids, disintegrated.

Cliques and Colleague Relationships Impact a Building's Climate. Three out of eleven participants reference cliques and colleague relationships impact a building's

climate. With a code frequency of seven, participant responses have been pared down to the following paraphrases and summaries capturing the key ideas. My former administrator had a clique, the participant explains, "it was this toxic good ole' boys club." As a teacher in the building, the educator describes how "you are impacted by the teachers who surround you." They elaborate that in secondary buildings, there can be just as many defined cliques for staff as there are for students. They clarify, "these people frame your lens on how you view the building and what is happening within it." Another spoke to changes in the staff lounge impacting how people gathered and socialized which hindered relationships and building climate. A different educator found that as the years progressed, less teachers were socializing with each other. This troubled the educator because when teachers are isolated in their classrooms it diminishes work morale and the climate in the building. Staff turnover impacted colleague relationships and the school climate for another person, and they noticed this the most during whole school meetings. They remember the overall vibe in the meeting space fell flat.

Administrator Dispositions. Eight out of eleven participants reference administrator dispositions and general persona, with a code frequency of thirty-two. Within the subtheme administrator dispositions major categories appeared: positive dispositions and negative dispositions. The codebook definition for administrator dispositions is a participant's individual perspective of their administrator's personality traits and character. Administrator dispositions are unique to the educator's shared experience with their leader, and a different teacher within the same building could view the administrator's dispositions and persona differently.

Positive Dispositions and Persona. Four out of eleven participants reference

having an administrator with a positive disposition and persona. With a code frequency of ten, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher outlines their administrator having "good leadership, a good educational system, and being very passionate about education." Another educator reflected that over the course of their career, their best administrators had a caring and relatable disposition. One stated, "any true leader will tell you that in a new situation, leaders need to craft trust and build respect in the people around them." While another shared that they desire to be valued and seen by their administrator, and "there were times where I felt supported and there were times where I didn't feel supported."

Negative Disposition and Persona. Five out of eleven participants reference having an administrator with a negative disposition or persona. With a code frequency of twenty-two, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. A teacher observed their administrator having a negative demeaner in a public way, "during meetings, acting unprofessional with facial expressions when staff shared." Another educator asserted their principal was never genuine, "if he did come check in and say how are you doing? It wasn't, I didn't feel like it was sincere. I feel like he was just making the rounds." One participant details an assistant principal that frequently talked down to teachers and tried to make comments to catch them off-guard. "You are pretty new around here" when the participant had taught over a decade in the building. However, the participant felt the assistant principal made this comment to disempower and belittle them. Another person felt like some administrators go into leadership because they love power, and the power

imbalance, even though they may not be conscious of it. And, so, "the de-emphasizing of a power imbalance is one of the greatest things that an administrator or a teacher can do for crafting capacity of their staff." On a similar note, one teacher referenced an administrator unwilling to admit mistakes or when they did not know something, "he'd made mistakes all the time, which everyone makes mistakes, but he would never own that," instead he would blame others for shortcomings, "like he never took credit for anything he did wrong." A different educator's administrator said, "misogynistic comments and things like that." Another had an administrator that talked down to them, "I'm not a student, you don't need to talk to me like I'm a student." Lastly, a participant endured an administrator that made staff feel replaceable, "I am disposable, and you've just made me realize that so, thanks."

Leadership Opportunities and Voice. Eight out of eleven participants reference leadership opportunities and voice, with a code frequency of twenty-six. Within the subtheme leadership opportunities and voice three major categories appeared (not in frequency order): leadership opportunities, voice, and a lack of leadership and/or voice. The codebook definition for leadership opportunities and voice was a participant's ability to share their viewpoints surrounding decisions that impact their classroom, content area, or building. And an educator's chance to hold positions of influence where they can lead initiatives.

Leadership Opportunities. Eight out of eleven participants reference having leadership opportunities. With a code frequency of fourteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. By engaging in leadership opportunities, one teacher highlights the "wide breath of

skills" and "depth of skills" that resulted, which had a direct impact on their ability to flourish in "complex teaching assignments." While acting as a teacher leader, another educator was exposed to multiple curricular cycles that varied in tasks and responsibilities, which set the stage for strong skill development that made them competitive as they transitioned into district leadership. These leadership opportunities taught the participant "lots of different things in terms of how the school system and building system work. And I wanted to continue to strive to learn more." Another person felt confident in their skill set and expertise, so they reached out to the district about implementing a new program. This program ended up spanning several years, included an extra stipend, and the creation of meaningful content that positively impacted other teachers and students across the district. This experience set a trajectory for them, by allowing them to see how rewarding leadership can be. The ability to participate in writing curriculum, math essential learner outcomes (ELOs), and district tests made a powerful impact on an educator. A different participant described how getting all these leadership opportunities created a need to rebalance life with work obligations. For one teacher, the time commitment that came with teaching and leadership roles, "dedicating adequate time to both. I was starting to realize that I needed to decide how much of an impact I wanted to have, and in which world, because it was becoming a lot." The participant ultimately went into district leadership.

One educator expressed contentment with their achievements in the classroom yet felt a pull to stretch themselves. The teacher debated applying for the district's leadership launch program. They explained, "It was like, why am I gonna apply for this? It was due at 11:59 pm, and I submitted it at like 10:30 pm … I'll just go ahead and do it … What is

the worst that could happen?" And it was this leadership opportunity that opened a door for them to be recruited into building leadership. Another educator's leadership program opened their eyes to the amount of satisfaction they felt from helping people.

Voice or a Seat at the Decision-Making Table. Two out of eleven participants reference having a voice or a seat at the decision-making table. With a code frequency of five, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. A teacher highlights the sense of professional growth and empowerment that comes from getting to sit at the table and voice one's vision for their content. They describe working on "NDE committees, working on science state standards, state tests, and science steering committees" and how the invitation to contribute was enriching. One educator shared a valuable experience serving on the principals advisory committee where they "just go to voice opinions on things that needed to be improved. I really enjoyed that, and I felt like I had a voice, and I also felt like I could preview some of the concerns that my colleagues had." Being invited to regular, monthly conversations allowed another participant, along with other teacher leaders, to have the opportunity to discuss building concerns and ask essential questions. Participants felt respect when asked to share their opinion. The amount of voice provided to one teacher made the decision to leave the classroom "more complicated and created more hesitation." They explain, "I felt like I had a voice and that it was considered. And so those things made me very hesitant to leave because I recognized what I had, it was a very special position and a very special place."

Lack of Leadership Opportunities and/or Voice. Three out of eleven participants reference having a lack of leadership opportunities and/or voice. With a code frequency

of seven, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. With a shift in leadership and school dynamic, a seasoned teacher with historic knowledge felt like "my opinions no longer carried any weight." One educator detailed frustration working under an administrator who had been a "big fish in a small pond," and the administrator wanted to "control people." In the process, the participant witnessed "every leadership mistake that you can imagine … and I was completely powerless and helpless to stop any of it." The lack of a teacher's voice created a "toxic environment" that was no longer sustainable for the educator. This teacher felt like the only influence they had was in voicing difficult questions, "I just asked questions … I was the only one doing it, and I wouldn't take any of it back. I'm proud of what I did because I can sleep at night. And I know that I at least tried." Additionally, a participant cites ramifications for when teachers did question decisions in their former district, a "swift and merciless non-justice will be taken against teachers who say anything negative … now that's toxic as hell. And completely unethical, but we find ourselves in this situation."

In another situation, a person went to administration to advocate for a different course load, and the principal "wouldn't even consider it." The educator explains that their leader did not consider their contributions to the content already, "I have written all of the curriculum. I want to teach classes that nobody else wants to teach. And I'm good at it, like I'm a good teacher." Yet, the administration had them remain in their current role since that position was even more difficult to fill. This response jilted the teacher, "and so, I'm like, okay, well then, I got to do something else."

Parental Support. Seven out of eleven participants reference parental support,

with a code frequency of twenty-four. Within the subtheme parental support three major categories appeared: parent communication, parental influence, and parent support. The codebook definition for parental support was the participant's perception of parents' behaviors towards the teacher and school.

Parent Communication. Five out of eleven participants reference parent communication positively or negatively. With a code frequency of thirteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Two participants spoke positive parent communication while the remaining three described negative communication. One teacher took pride in handling parent concerns. They felt confident in their ability to listen and find solutions that aligned with the parent's desires for their child. The fact that a disgruntled parent never went to administration was a "badge of honor" for this educator. The other teacher outlines the clear tone their administrator set, an expectation of how parents would communicate with the staff. They usually took a proactive approach, "I wasn't afraid to chat with them or call them" and parents were receptive to the message.

Another participant catalogs the emotional reaction of receiving a negative parent email, like, when a parent is not pleased, "I would just lose it." The stress of navigating the situation was all consuming for the teacher. These memories inform their reaction as a current administrator, "you see how a teacher feels so relieved, and you just know that they felt supported in those moments." A different educator describes the feeling, "all on my own, I'm on an island" dealing with parent questions and concerns. The third teacher tried doing the right thing by communicating with parents through email and phone call, yet parent mistreatment made them feel like it was time to leave the classroom, "I just got

yelled at by one [parent], and like, is this what teaching is, because I don't think I like this."

   Parent's Influence over their Classroom. Five out of eleven participants reference a parent's influence over their classroom. With a code frequency of thirteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One participant struggled with parents wielding their influence to retract decisions made by the classroom teacher. It was hard for the educator to watch a student who was underperforming "get everything handed to [them]." As a teacher, they wanted to support, grow, and develop students. Bending to the parent's desires conflicted with these values when the parent requests did not adhere to classroom policies. Another educator recounts weekly emails to parents about student missing work. When grades are about to be due, the parent expects their student to have the ability to turn in all their late assignments. They explain how the parent complained that the teacher was unfair for not extending deadlines and their administration told them to provide an extension. While a high school math teacher states, "the lengths that we had to go to, to appease parents … was a big tipping point for me." The parents were not only demanding, but they were also mean and degrading. One person explained that the building message was "to do what the parent said and there was nothing the teacher could do about it." If the participant ever wanted to dispute the parent, they needed to show proof before an administrator would consider giving them support, which meant that parents could influence pretty much any decision. Another educator describes how administration's response to parents became complacent, where their administration placated parents at the teachers' expense, "they didn't want a lawsuit, you know, it's like,

get this off my desk, do whatever they ask … it got so out of control."

A Change in Parental Support. Three out of eleven participants reference a change in parental support. With a code frequency of four, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Over the course of their career, an educator notes the change in parental support, "fewer and fewer parents reached out for anything or responded to [emails]." Another teacher was sick of mistreatment by parents. They do not believe the teacher, for example, a "parent was so mean to me, and like the kid was cheating. I caught them." Yet the parent claims the student did not cheat and demand the teacher to retract the penalty. The third person claims that parents can fall onto two sides of the spectrum, helicopter parents or completely disengaged, and both sides of the spectrum are difficult to manage.

In closure of building working conditions, STEM teacher attrition is often exacerbated by a myriad of factors within school environments. Poor building conditions, such as overwhelming workloads, difficult student behavior, and unsupportive school climates, contribute to high levels of stress and burnout among educators. Additionally, negative experiences with administrators, including a lack of support or recognition for teachers' efforts, can further erode morale and job satisfaction. Colleague relationships also play a significant role, as a lack of collaboration or professional respect can leave teachers feeling isolated and undervalued. Furthermore, limited leadership opportunities and voice in decision-making processes can lead to feelings of disempowerment and frustration. Finally, inadequate parental support, whether through lack of engagement or hostility towards educators, adds another layer of strain on STEM teachers, ultimately driving many to seek alternative career paths.

Internal Building Systems

The codebook explanation for internal building systems describes structures that are consistent from one year to the next year and tend to not vary with a change in administration. The following subthemes for internal building systems, in code frequency and density order, administrative tasks of leadership, mentoring, plan time, student discipline, and professional learning communities.

Administrator Tasks of Leadership. Ten out of eleven participants reference the administrator's ability to complete tasks of leadership with a code frequency of forty-two comments. Within the subcode administrator tasks of leadership three main categories appeared: the growth and development of staff, response to student and parent concerns; and visibility and support. The codebook definition for administrator tasks of leadership is the participant's perception of the administrator's capability to execute job responsibilities.

Teacher Growth and Development. Eight out of eleven participants referenced teacher growth and development. With a code frequency of twenty, participant responses can be placed in the minor categories of feedback and observations, grow staff, and hold staff accountable. The codebook definition for teacher growth and development was the administrator's role in providing feedback and continuing education to grow instructional methods in staff.

Three out of eleven participants reference feedback and observations in regard to teacher growth and development. With a code frequency of six, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the

key ideas. Participant responses regarding their administrator's ability to complete

administrative tasks vary greatly based on the unique lens of the educator. One teacher

shared that they had an awesome principal who mentored them throughout their career.

They explain, "there is a principal I can tie a lot of instructional accomplishments to."

While, conversely, another educator had an opposite experience, "I mean, honestly

terrible … it was his first year as a principal, I'm sure he didn't know what he was doing

as a mentor for a new teacher coming in," but he would send video clips instead of

providing clear feedback on areas of development and growth. One participant described

a work environment that did not allow for administrators provide feedback, "teachers

could be more supported if admin didn't have so much to do … the admin has to do and

deal with so much.... That doing things like actually giving good constructive feedback to

a teacher is impossible." A different educator thought their principal's pop in and out

observations with no feedback to be worthless, "super-disengaged when he came in …

he'd just mark on his iPad that he did a walk-through and served you, and never any

feedback, ever."

Six out of eleven participants reference a desire for professional growth. With a

code frequency of nine comments, participant responses have been pared down to the

following quotes, paraphrases, and summaries capturing the key ideas. A teacher

cataloged the excellent leaders from their career, each saw value in staff and looked for

opportunities to provide them "great leadership opportunities." Another educator had an

administrator that really elevated them and could see their potential before they did. Their

administrator would continuously encourage them to take a risk and try new things. They

find this has come "full circle" now that they are an administrator themselves. A different

person saw their administrator's strength in growing staff because "a big part of leadership is building capacity" and their principal had a clear vision of excellence and moved the building in that direction. While one participant had difficulty receiving professional development from their administrator because they did not respect them as a teacher, "like you're lecturing me on good teaching practices, like please, you showed videos every day, like I knew what your class was like."

Three out of eleven participants reference holding staff accountable. With a code frequency of five, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator spoke to effective principals empowering teachers, unlike their principal who micromanaged them, "you don't need to be hovering over the top of me to get my job done." Another teacher wanted an administrator that held staff accountable for adhering to building expectations and rules. They described disintegrating staff behaviors, "one teacher, she wore jeans every day for 2 years, and nobody said anything." While another found blanket emails to handle individual personnel issues to be aggravating, "you're treating me like them, and I didn't even do anything." A different teacher's principal would move stellar staff around to address staffing concerns instead of handling the issue directly, "they took me away, like [staff name] and I were the freaking dream team … then they took me out of there and put me with the shit teachers thinking that I could help them."

Student and Parent Concerns. Six out of eleven participants reference student and parent concerns. With a code frequency of eleven, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. A participant describes being supported and respected by the administration, which was

the most apparent when handling an upset parent. Their administration would "disarm and de-escalate a situation" and create "approaches" that balanced the teacher's needs and the parents. While another educator desired an administrator that supported teacher's classroom decisions. Instead, their principal would follow the parent's whims, "well, this parent called, we gotta do what they said and I'm like, okay … a lot of, just like, nothing we can do about it, so okay, alright." They felt he had no backbone with parents. A different participant remembers their assistant principal being bad with students. They explained he spoke unkindly and could not handle student behaviors. One mentioned an administrator who expected the teacher to do all the heavy lifting with behavior, such as communicating with parents and managing lunch detentions. Multiple educators spoke to administrators' failure to address behavior concerns when a student goes to the office. They wanted the office to keep the student until class concluded. One teacher added that when they sent a student to the office, they were "maxed out." They needed to continue teaching the class, not dealing with a return student who is strutting in with a "snack and juice box," completely unphased, and still on display with peers, trying to save face from being sent out. While another person recognized their administrator could make ethical, moral decisions about students and the building, overall, the administrator had "restorative practices."

Visibility and Support. Six out of eleven participants reference visibility and support. With a code frequency of eleven, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. In regard to visibility, accessibility, and supportiveness, five participants agreed that they had great leadership who was present in the building, in classrooms, and asking check-in questions

with teachers. One teacher expanded that an administrators' ability to be present and walking the building allowed them to have a more accurate view of the building. While a different educator shared, "you never saw him in the hall" when describing the presence of their administrator in the building.

Mentoring. Ten out of eleven participants reference the building's mentoring system with a code frequency of thirty-nine. Within the subtheme mentoring three main categories appeared: mentorship impact, formal versus informal mentorship, and mentorship qualities. The codebook definition for mentoring was a participant's perspective of formal or informal colleague interactions is rooted in intentional development and growth in classroom instruction and practices.

Mentorship Impact. Nine out of eleven participants reference mentorship impact on their career. With a code frequency of sixteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher described mentorship as a non-evaluative person who provides feedback and guidance. They can provide perspective, as a participant said, "I think the mentorship, for sure, gave me value in my work." An educator shared the positive impact their mentor made on them professionally. The teacher's mentor "planted seeds" of success and facilitated fruitful conversations that allowed them to better evaluate themselves, "it was the first time I had really gone, Oh! I'm good at something … and I had seen my own potential." Another person's mentors had a tremendous impact on their career, and they do not take these mentorship experiences for granted, in fact "I'm still in communication with many of them." A different educator reflected that without their mentor, they would have left the profession earlier, "I would have left the career much sooner because I think

I would have felt overwhelmed all the time." Multiple participants reported that their mentors are the reason they are in a leadership role, because their mentor invested time in them, encouraged them, and gave them wings. One elaborated, "I have been very, very fortunate and very blessed to have been mentored by great leaders who have helped me to get to where I am today."

One teacher did not have a positive mentorship experience, "when I was starting, I had to learn the majority of it on my own and the only reason why I learned it on my own is because I was willing and wanted to make proactive changes." Another educator felt deflated after engaging with their mentor, they did not provide any help or advice, creating an overall negative impact on their work dispositions.

Formal and Informal Mentorship. Five out of eleven participants reference their experiences with formal and informal mentorship. With a code frequency of fifteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Participants had mixed reviews when describing formal mentorship programs. When transitioning from their teacher preparation program into classroom, the educator had "a great mentorship system set up through [their] master's program." Another teacher believes that administrators need to be intentional when creating formal mentorships, "assigning mentors randomly, that's where the error lies in my opinion. That mentor assignment should not be done before somebody even steps into the seat." This participant stated that formal mentorships "should be done over the first six months, in which you figure out what a mentee needs and then you go from there." Another teacher echoed that mentorship partnerships cannot be random, and administration needs to consider age, content, and personality.

A former middle school teacher was assigned a mentor that, "I legitimately think I did not speak to them until November "because the teacher was in a different grade level and content area. Another educator had a similar formal mentor experience in their first year of teaching, and their mentor did not do anything besides provide worksheets or test preparation materials. This was not the support they desired and ultimately played a role in them deciding to switch buildings because "I didn't feel a strong connection or support."

A different teacher had negative experiences of being assigned to mentor struggling staff. One explained, "they would hire these horrible teachers and they would partner me with them … like, oh, she has horrible classroom management, so we're gonna put [participant name] with her." The educator depicted the strained mentor/mentee relationships they endured, because the administration was not transparent about the partnership, and the mentee teacher was not interested in being developed by a peer.

Conversely, participants found value in informal mentorships. One teacher describes the "amazing people who supported" them through a "more informal mentorship" which was extremely beneficial "anytime [they] wanted to try anything new." Another educator relates their most meaningful mentors to be ones they self-selected. They elaborated that this allowed them to establish their own area of growth, seek out a colleague they respected, and work towards their instructional goals. They recall, "It was a thing of beauty, and it was wonderful, and we accomplished so much." A person reports that they like to select their own mentor because the person needs to match their passion, "I'm not interested in having mentors who are not willing to keep up with

me, which has been kind of a theme in my career."

Positive Mentor Qualities. Four out of eleven participants reference positive mentor qualities they have encountered. With a code frequency of eight, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. After years of both successful and failed mentorships, a participant explains that mentorship should not be about telling, but asking questions, because "I believe very strongly in mentees making decisions for themselves." They also state that mentors should avoid giving advice because "advice does not work for people, because most of the time advice is given by people who do not have a full understanding of the variables and who do not have skin in the game." Another teacher shared that their mentor gave welcoming vibes and had a helpful spirit about them. One educator found value in mentors who empowered them, provided skills-based instruction, and gave them opportunities to lead the discussion. Two participants referenced having mentors who listened for what they needed and provided clear guidance.

Plan Time. Nine out of eleven participants reference plan time, with a code frequency of twenty-four. Within the subtheme plan time four main categories appeared (not in code frequency order): plan time, number of teacher preparations with one plan period, loss of plan time, and needing more plan time. The codebook definition for plan time was the allocated time during the participant's daily schedule for completing workload tasks.

Use of Plan Time. Five out of eleven participants reference the impact of building systems surrounding plan time. With a code frequency of seven, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the

key ideas. According to one teacher, plan time is often spent responding to emails, contacting parents, and meeting with colleagues, "but the real work … the planning that needs to be done, is difficult, time consuming, and requires continued brain power." A different educator adds that plan time can easily be filled by teachers checking items off their instructional to-do list; however, it does not provide an opportunity to collaborate with their subject peers. Another person elaborates that plan time is not just used for preparing a lab or activity, it is also "planning for error" that happens in a lesson. They clarify that even a seasoned teacher is using plan time to adjust after the days lesson for the "curveballs" because "I did not see that coming and now we need to change course completely. That can be stressful." Plan time became absorbed by parent communication for one teacher, who details their behavioral philosophy, "I like to be pretty proactive about things. So, communication [with parents] …the hard part … is finding time in a day."

Number of Teacher Preparations with One Plan Period. Three out of eleven participants reference the number of teacher preparations with one plan period. With a code frequency of four, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. With multiple class preparations, it is difficult for a STEM teacher to feel like they can get ahead because, as one educator explained, they want to do better than the year before which means they cannot recycle and regurgitate the same lesson. Each year, planning and innovation that goes into improving each course is overwhelming and difficult to manage. A middle school math teacher stated that they have a heavier planning burden with three or four class preparations than other middle school content areas that only have one class to plan

and prepare. Another educator recounts losing plan time and gaining an additional course a few years back, which overextended them as a teacher. A different teacher describes the strain of teaching multiple courses in a high school environment and needing to prep various classrooms for a day's lesson, "walking up and down the stairs all day is exhausting. Kids could never find me."

Loss of Plan Time. Three out of eleven participants reference a loss of plan time. With a code frequency of four, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator wished they had twice the plan time to get work tasks completed during the actual workday. A different teacher remembers previously having more plan time, and the subsequent strain that occurred when it got cut. With the teacher shortage and vacant classrooms, one person spoke to teachers losing their plan time to teaching an "overage" class. Another participant explained how the substitute shortages have caused them to frequently lose their plan time to cover an unfilled sub job in the building. A different educator stated when schools came back after COVID-19, "it just went down from there because we were covering for other teachers who were gone because we didn't have subs … we essentially had zero plan time by the time I left." Due to shortages of general staff, some teachers lost their plan time to assisting with building responsibilities that would otherwise have been left incomplete. One participant had administrative intern responsibilities for their elective class, the explained that they frequently lost some or all of their plan time because secretaries would continue to send them students long after the "elective class" time had concluded.

Needing More Plan Time. Six out of eleven participants reference needing more

plan time. With a code frequency of nine, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. A participant firmly believes that the school day needs to be restructured because the current system does not work, "I think it's very unrealistic to think of all the things to do – the planning, assessing, communication, all of those pieces. I think it's unrealistic to think any person could that in a plan period." They elaborate, "I mean, by the time I go to the bathroom, scroll through emails, not check, just scroll to make sure there are no admin messages, that's easily 15 minutes already gone." A typical plan period does not suffice, as one teacher explains, "I was up early lesson planning and getting ready for the instructional day because I took pride in my classroom." Another educator said what they needed to accomplish each day "far surpassed any plan time [they] ever had. And so, [they] felt like [their] job was always on [their] mind." When considering the data that teachers are now provided through formative checks and assessments like MAP, one teacher details "it takes extra time to use instructional data and it's good work but it's hard work."

Another educator claims that visionary, long-term planning cannot be accomplished within the bounds of a regular plan time. A different teacher felt "stress in covering every second of the day. It really got to me. Like, I love preparing and I love thinking through and analyzing how to help someone to improve." However, the participant relayed that this level of planning for growth and development had a cost, "if I don't get the time to prep for that, if I don't get time to analyze that, then I'm like this isn't going well and then I just get stressed and anxious, and it was a little bit tough." Participants found plan time did not meet their basic needs of completing tasks and found inadequate plan time to be unsustainable. One educator said, "[I] had a 45-minute plan

time. So, towards the end, which was obviously a big decision maker, I did not feel like I had enough time to get everything done within a workday." This meant that the teacher "was working so much outside of teaching, outside of school, in the evenings, the weekends … everything."

Student Discipline. Eight out of eleven participants reference building disciplinary response systems for student behavior, with a code frequency of sixteen. Within the subtheme student discipline five major categories appeared: administrative support and response; proactive systems; tiers of support and intervention; a lack of consequences; and the reason for attrition. The codebook definition for student discipline is a participant's perception of student behavior issues that warranted administrative response and support.

Administrative Support and Response. Four out of eleven participants reference administrative support and response. With a code frequency of five, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One participant felt a lack of administrative support, because "no one was held accountable for anything. And so, people just start doing whatever they wanted." A different educator desired administrative support in response to behaviors and thought their principal could have benefited from additional skill development, "just violent behaviors or defiance, just frustrated by it, and not feeling supported by the leadership to be able to handle behaviors, or not having the skills that are needed to be equipped to battle those behaviors." Another teacher recounts the frustration they felt when their administrator provided poor advice for responding to student behavior, "I've tried ten things and I'm providing evidence of that. I've cc'ed you on everything … but now

you're saying that we're just gonna go back to step one, that I've tried three times." This educator did not experience "a whole lot of troubleshooting in terms of problem-solving those tough situations." Conversely, another person did feel supported behavior-wise because they had all the resources, the paraprofessionals, behavior interventionalists, and behavior team meetings in their building. They reported clear systems in place to address student behavior and support the classroom teacher.

Proactive Systems. Three out of eleven participants reference proactive systems. With a code frequency of three, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One participant chronicled how their new administrator lacked proactive approaches in comparison to their retired principal. At the start of their career, their administration had clear expectations for proactive responses to student behavior. For example, "you need to be out in the hall. It reduces behavior, you know, there are less conflicts in the hallways if teachers are around. So that was my first few years, the bell rang, and you were in the hall." When the new administration took over, proactive approaches began to slide because the principal did not model or reinforce it. The educator continues, "The principals were never out. So, then we started, like, no I'm gonna go check my phone, I'm gonna go get a snack, I'm gonna go take care of my needs" which gradually turned into more student behaviors occurring within the building. A different teacher echoed that they just wanted the building to have a behavior management plan that focused on proactive approaches instead of being so reactionary.

Tiers of Support and Intervention. Three out of eleven participants reference tiers of support and intervention. With a code frequency of three, participant responses

have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. An educator witnessed students on behavior plans who were not making any progress. This teacher noticed the tiers of support were in place, yet students were just being moved along with minimal impact or change. Another person observed student behaviors that were "destroying classrooms" and in some resource classrooms kids were "physically assaulting their teachers" and it became apparent that better behavior systems needed to be implemented. The participant continued that their school was not taking "behavior interventionism to a serious level."

Lack of Consequence. Two out of eleven participants reference a lack of consequence in response to student behavior. With a code frequency of two, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher stated that there was a general sense that students would not receive a consequence if they were sent to the office. They describe feeling like there was no real incentive for improvement in student behavior, "if I sent [a student] down, the kid would get talked to … but do I feel like their behavior changed based on that interaction with the admin, I don't know." Another educator experienced annoyance at, "sending a kid to the office and they come back with a drink and a snack and you're like, okay, really?"

Student Discipline. One out of eleven participants referenced student discipline as the reason for attrition. With a code frequency of three, the participant's responses have been pared down to the following quote and summary capturing the key ideas. When considering the reasons that the educator left the classroom, they explain that "it is more or less discipline related." And they appreciate that in their new job they do not have to

measure the success of their day by the behavior of others.

Professional Learning Communities. Five out of eleven participants reference professional learning communities, with a code frequency of sixteen. Within the subtheme Professional Learning Communities (PLC) two main categories appeared: professional growth and instituting change. The codebook definition was a professional learning community (PLC) is a formal grouping of educators based upon content and grade level. This group meets in regular intervals to discuss student academic progress, curriculum, and assessment results.

Professional Learning Communities and Professional Growth. Five out of eleven participants reference professional learning communities and professional growth. With a code frequency of nine, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. PLCs can tackle instructional shifts; one teacher noted the shift from memorizing science vocabulary terms to focusing on critical thinking. The educator expounded that this was not easy for all science teachers to embrace; however, tackling this as a PLC helped to nudge the teachers who were afraid of change. They concluded that critical conversations were had about, "it is not just memorizing aspects of plate tectonics. It is so much more than that. Our responsibility is so much greater than that." One teacher perceived value in the districts allocated time to discuss and collaborate with other buildings. They thought it was good to hear what they were implementing and a litmus test in their own classroom, which allowed them to improve and institute new ideas. Another person said that PLCs allow teachers to lean into their strengths, "when it's good, it can create opportunities for mentorship and collaboration." It can be "a thing of beauty and wonderful, we

accomplished so much," the educator reflected. A different teacher shared how PLC conversations can address items teachers are struggling with and colleagues can share, "here's something that I'm doing under these circumstances." They elaborated that it can be just in time mentoring and professional development.

    Professional Learning Communities and Instituting Change. Three out of eleven participants reference professional learning communities and instituting change. With a code frequency of three, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher conveyed that allocated time to collaborate in a professional learning community was invaluable. The ability to discuss challenges and successes in instruction and assessment made a huge impact on the participants' own best practices in instruction. A different educator recognized that PLC conversations allow you to "dive into standards and curriculum, and understanding like what we are really trying to accomplish here." Another person found that as a PLC they could institute big changes, ideas, initiatives. They explained that this was possible through common goals that pushed each other outside of their comfort zones. In this PLC environment, the teacher felt that everyone brought different strengths to the table which helped to broaden their lens, "make you looks at things from a different angle." They continued that their most productive PLCs honored individual's strengths and realized that not everyone could be the same. Prior to budget cuts, increased class sizes, and additional instructional periods, an educator notes that they had more time to meet with their math colleagues and "that's where we made the magic happen. To have that taken away … was very frustrating." They recount that they had to be ok with things not looking the same and lowering the bar in their

instruction.

In closure, the effectiveness of internal building systems, encompassing administrator tasks such as leadership, mentoring, planning time allocation, student discipline protocols, and professional learning communities, plays a pivotal role in mitigating STEM teacher attrition. Adequate leadership fosters a supportive environment that values teacher input and professional growth, while effective mentoring programs provide guidance and assistance to new teachers, reducing feelings of isolation and burnout. Additionally, sufficient planning time allows educators to prepare engaging lessons, leading to higher job satisfaction. Well-defined student discipline policies create a conducive learning environment, minimizing disruptions that contribute to teacher stress. Furthermore, participation in professional learning communities facilitates collaboration and knowledge sharing, enhancing teacher effectiveness and job satisfaction. Overall, a robust internal building system not only supports STEM teachers in their professional development but also fosters a sense of belonging and purpose, thereby reducing attrition rates.

In contrast, when internal building systems are lacking or inadequately implemented, STEM teacher attrition can escalate. Absence of strong leadership results in a lack of direction and support, leading to feelings of frustration and disillusionment among educators. Without effective mentoring programs, new teachers may struggle to navigate the challenges of the profession, increasing their likelihood of early departure. Insufficient planning time leaves teachers overwhelmed and unable to deliver quality instruction, contributing to job dissatisfaction and burnout. In the absence of clear student discipline policies, teachers may face constant disruptions in the classroom, further

exacerbating stress levels and driving them to seek alternative career paths. Moreover, without opportunities for collaboration and professional growth within learning communities, teachers may feel isolated and stagnant in their careers, prompting them to leave the profession in search of more fulfilling opportunities. Thus, the absence of robust internal building systems significantly heightens the risk of STEM teacher attrition, posing a threat to educational continuity and student achievement.

Building Demographics

The codebook definition for building demographics is determined by statistical data related to a population's size, location, age range, and socio-economic status. The following major categories for building demographics, in code frequency and density order, location; level; and Title I, poverty rates, and free and reduced lunch programs.

Location – Urban, Suburban, and Rural. Eleven out of eleven participants reference locations, with a code frequency of twenty-nine. Within the subtheme location three major categories appeared: rural, suburban, and urban. Two participants worked in both a rural and suburban location and shared their perspectives from both experiences.

Rural Environment. Two out of eleven participants reference working in a rural environment. With a code frequency of twenty-one, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Both rural school participants spoke in length about their experiences. They explained that they came from a small town and felt the "most comfortable" returning to a small town to teach. One teacher desired the smaller, rural schools because they could know all the students by name and know their family, which later assisted them with classroom

management. They recounted, "when you only have 40 kids in a graduating class, the discipline issues are just different." The participant discerned like they had richer relationships with students because they coached two sports in town. Also, this educator liked the accessibility of the superintendent and felt supported and mentored by the superintendent. This teacher ultimately left the rural school district because of their spouse's job.

The second rural district educator felt the draw to return to their hometown after graduating. The teacher saw value in returning to their former district because of the community support and "good safety nets in place." They enjoyed the feelings of celebrity that comes from teaching in a rural community and the sense of unity, "everyone in town comes to the sporting events." The educator established this to be a drawback, too, because it blurred their professional and personal life. Also, they noticed they had less access to resources and fewer curriculum systems of support. In their school, the participant was the only teacher in their content area, so all the responsibilities fell on their shoulders, which became stressful when needing to increase student proficiencies. They explained that small town schools can mirror the needs of larger, diverse school districts without the support staff to address these needs, causing rural staff to wear more hats. Lastly, this teacher felt like their rural district was behind the times compared to what larger districts were doing. They, too, ultimately left their rural school district because of a marriage, and their spouse wanting more amenities than a rural community could provide, including the university where their significant other was still a student. The educator elaborated that at the time, the community did not have a lot to offer a young couple, it has since grown and established some great entertainment

features.

 Suburban Environment. Ten out of eleven participants reference working in a suburban environment. With a code frequency of thirteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One participant described picking the same suburban district that their children went to school in so they could share a similar schedule. Also, this teacher highlighted that the district was growing and exciting things were on the horizon for the community and district. Another educator found their former districts proximity to resources to be an appealing draw since they frequently partnered with a nearby university. A different person worked in an alternative high school where they had "lots of kids with ankle monitors," and found this district to provide the necessary supports and resources they needed to effectively do their job.

 A handful of participants discussed weighing the options of migrating from one suburban district to another suburban district. One teacher had thought seriously about moving to a more affluent suburban district in hopes that it would be easier. They expanded that they ultimately did not because the "grass is not always greener," and some of their friends in those other districts had also considered leaving because they were unhappy. Similarly, a different educator had considered migrating because of the rhetoric that affluent districts have easier students, smaller class sizes, better pay, and more support from administration. They discovered that these things may not be true; however, this was the narrative. Another teacher migrated to another suburban district for a leadership position. This opportunity has allowed the educator to learn the new structures and systems of a district which has been "a great experience."

Urban Environment. One out of eleven participants referenced working in an urban environment. With a code frequency of five, participant responses have been pared down to the following summaries capturing the key ideas. During a participant's undergraduate experience, they had the opportunity to tutor students from both suburban and urban school environments. They chose to work in the urban environment because of the programming options and ability to provide impact on a larger, more diverse population.

Level – High school/Middle School. Eleven out of eleven participants reference working in a secondary school, with a code frequency of nine. Within the subtheme level two major categories appeared: high school and middle school. One participant worked at both the high school and middle school level. The codebook definition for level was middle school includes sixth, seventh, and eighth grade students while high school includes freshman, sophomores, juniors, and seniors.

Seven participants worked in a high school while five worked in a middle school. One educator describes the high school teacher life as an extension of your family because of all the events teachers participate in after hours and bring their own children to, such as, sporting events and post-prom. When the teacher made the choice to leave education their children lost a part of their community. Another educator picked high school because they felt that middle schoolers "have an attitude, they're too cool for school" and they did not think that could make an impact with this age group. While another person taught one year in high school and determined the middle school was a better fit. One teacher shared a similar view stating, "I felt like high school was so focused on credits and grades for student graduation while the reality in middle school is

that none of that matter. We're gonna learn, have fun, and be better learners." A different educator's perspective was that high school teachers are curriculum focused with a passion for their content, while middle school teachers focused more on the whole child.

Title I, Poverty Rates, and Free and Reduced Lunch Program. Four out of eleven participants reference working in a Title I; high poverty rates; and/or school with a high rate of free and reduced lunch. All four educators spoke fondly of working in a Title I building due to the impact they could make on students. One teacher stated, "you gotta take students where they're at and help them grow, no matter what. And I think it's because we're in public education, we can't ever turn a kid away." They felt compelled to be a part of their student's growth "trajectory." When this person got to celebrate their students on graduation day or by being invited to graduate parties, "it was just so cool to see the impact you can make." A different educator expressed a similar sentiment of having the ability to "meet the kids where they are" despite the severe hardships some of them encountered, explaining "we have kids that are seriously homeless and there is no foster home for them. So, they live in a shelter, and they take a taxi to school every day. And supporting all kids is why I went into teaching." Another educator shared that as a teacher in a Title I building, there is a constant balance between recognizing students' unique personal needs with their academic growth,

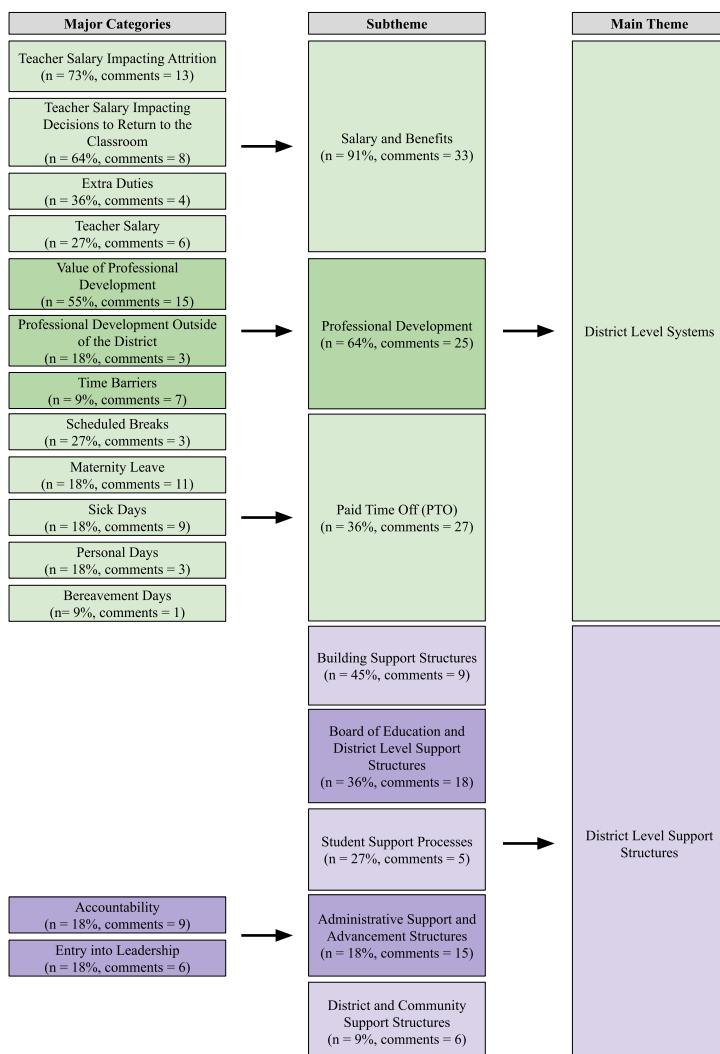> I loved the school where I was and I know that compared to other schools it was cake, right? And compared to some other schools, it was difficult. So, there are times where you felt the burnout of some of the social dynamics of the students' lives. For example, you know, kids would come and I'm like, I know your home life and you've told me about your home life. And it's hard. And now I'm trying

to help you find joy and play with magnets or whatever, like learning about

magnetic properties. Cool, that's great. And you're thinking about why your mom

and dad were fighting last night or why your dad left."

In closure of building demographics, no trends appeared in STEM teacher

attrition regarding school location or level. Rural STEM teachers did not cite the school

as their primary reason for leaving, rather it was the lack of resources within the

community to support their spouse/family. Also, STEM teachers are not leaving Title I

schools because of low socio-economic status students. These teachers reference feeling

value and purpose being able to impact and support these students. However, these

educators do mention disenchantment with administration or educational systems to

support Title I students.

Participants Perception of Local District

Participant responses related to their former and/or current district are organized

into district level systems and district level support structures. Subthemes and categories

surfaced during thematic analysis. These elements are listed in sequential order of highest

density in participant responses and code frequency. The organization of district level

responses fell into main themes, subthemes, and major categories which created an image

of former STEM teacher's perception of district's structure and systems (see Figure 6).

The number of participants and frequency of comments assisted in arranging topics

surrounding participants perceptions of their attrition from STEM classroom, with the

most important information coming from personal narratives.

Figure 6

District Level STEM Teacher Attrition Response Themes

Major Categories	Subtheme	Main Theme
Teacher Salary Impacting Attrition (n = 73%, comments = 13)	Salary and Benefits (n = 91%, comments = 33)	District Level Systems
Teacher Salary Impacting Decisions to Return to the Classroom (n = 64%, comments = 8)		
Extra Duties (n = 36%, comments = 4)		
Teacher Salary (n = 27%, comments = 6)		
Value of Professional Development (n = 55%, comments = 15)	Professional Development (n = 64%, comments = 25)	
Professional Development Outside of the District (n = 18%, comments = 3)		
Time Barriers (n = 9%, comments = 7)		
Scheduled Breaks (n = 27%, comments = 3)	Paid Time Off (PTO) (n = 36%, comments = 27)	
Maternity Leave (n = 18%, comments = 11)		
Sick Days (n = 18%, comments = 9)		
Personal Days (n = 18%, comments = 3)		
Bereavement Days (n= 9%, comments = 1)		
	Building Support Structures (n = 45%, comments = 9)	District Level Support Structures
	Board of Education and District Level Support Structures (n = 36%, comments = 18)	
	Student Support Processes (n = 27%, comments = 5)	
Accountability (n = 18%, comments = 9)	Administrative Support and Advancement Structures (n = 18%, comments = 15)	
Entry into Leadership (n = 18%, comments = 6)		
	District and Community Support Structures (n = 9%, comments = 6)	

Note. N=11. Subthemes and major categories are organized from highest density in participant response and highest frequency in comments. Colors are to designate between main themes.

District Level Systems

The codebook definition for district level systems was district systems consistent from building to building and year to year and tend to not change without district board approval. The following subthemes for district level systems, in code density and

frequency order, salary and benefits; paid time off; and professional development. Paid time off had a lower participant density and higher code frequency than professional development; however, paid time off is listed first due to participant responses relating more to reasons for attrition.

Salary and Benefits. Ten out of eleven participants reference salary and benefits with a code frequency of thirty-three. Within the subtheme salary and benefits, four major categories appeared (not in density order): teacher salary, extra duties, teacher salary impact on attrition, and teacher salary impact on returning to the classroom. The codebook definition for salary and benefits was a participant's annual salary, health care coverage, and retirement package.

Teacher's Salary. Three out of eleven participants reference teacher salary. With a code frequency of six, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator tells how teacher salary schedules have remained pretty flat, with just cost of living adjustments, yet the workload is increasing. They elaborate that when they started teaching, they had seventy less students, "so that's like 2 classes of extra grading, which created a completely different workload with no change in pay." A different teacher highlighted the disadvantage of low salary, yet the positive of having a steadiness in their benefits and salary. They expanded that when "economics are crazy, there was such value in a salaried job that had defined benefits." Another person found merit to teacher benefits and pension packages; however, they felt like teachers are "held hostage by it." They describe how after a certain point, even if they did not want to remain in the classroom due to salary constraints, they are stuck because they would lose their retirement. While

another educator considered migrating to a new district that offered better pay for doing the same job. A different teacher became the most disenchanted with teacher salary and benefits when having to take their maternity leave unpaid. They recounted that teacher salary is already low and then having to go unpaid on maternity leave, even with spreading that loss over 3 months, it made their monthly salary impossible to sustain a growing family on.

Extra Duties. Four out of eleven participants reference extra duties. With a code frequency of four, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator shared that you do not get real raises as a teacher, so to make extra money you have to coach or work sporting event games, which only increases your workload. Another person said that to make a living wage teaching, they had to take on extra duties just to fill the financial gap. A different participant details needing to take a part-time job, where they worked 12 hours a week, to make up the difference in the shortfall of their salary. While another educator raised that teachers need to be compensated more for taking on additional district tasks because, currently, "we are rewarding high performing teachers by giving them higher pay only when they move into administration."

Teacher Salary Impacting Attrition. Eight out of eleven participants reference teacher salary impacting attrition. With a code frequency of fifteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. "To be totally up front, [I left for] more opportunity to make money," a teacher admits. Another educator received a 15% pay increase when taking an administrative position in the district. One participant shared, "I mean, that's part of it, truthfully,

money," when describing looking for a position that could compensate them fairly for their talents and skills. A person who took a position outside of education had a similar base pay as teaching; however, lots of opportunities for commission. They highlighted that the commission structure made the pay much higher than a teacher's salary. They enjoyed having more control over their salary since teacher pay is pretty structured. Another educator did not realize how much a high salary would impact feelings of stability in their family.

Not all teachers left education in pursuit of higher salaries. One educator stated, when they left teaching "there was a pay cut, but I could see that there was a future there." This person expanded that they took a pay cut because they knew there would be better working conditions and the pay would increase overtime to be more than teaching could ever offer. A different teacher took a pay cut when they left the classroom; however, they valued their time at home with kids more than a higher salary. Another educator was not looking for more pay, just equal pay when deciding to leave the classroom, "like the salary needed to be comparable." A teacher that became an administrative intern explains that their salary remained the same when they stepped away from the classroom; "just like teachers don't go into teaching for the money, I was not going into administration just for the pay boost," which did come when they became a principal. On a different note, one educator was more concerned about finding equivalent benefits rather than a higher salary, stating that it was difficult to find "affordable health care, which doesn't exist by the way."

Teacher Salary Impacting Their Decision to Return to the Classroom. Seven out of eleven participants reference teacher salary impacting their decision to return to the

classroom. With a code frequency of eight, participant responses have been pared down to key ideas. Six participants indicated they would need teacher salaries to increase before even considering a return to the classroom. While only one participant felt comfortable transitioning back into the classroom with no increase in the current salary schedule.

Paid Time Off (PTO). Four out of eleven participants reference paid time off (PTO) with a code frequency of twenty-seven. Within the subtheme paid time off, five major categories appeared (not in frequency order): maternity leave, sick days, personal days, bereavement day, and scheduled breaks. Paid time off includes maternity leave, sick days, personal days, bereavement days, and scheduled breaks.

Maternity Leave. Two out of eleven participants reference maternity leave in regard to paid time off. With a code frequency of eleven, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator spoke in detail about breaks in the maternity leave system at their former district. For starters, the participant describes the inability for the district to secure a substitute in their content area, which made the planning and preparing for a long-term substitute more difficult. Because the substitute had a deficit in math skills, the teacher needed to provide the substitute with additional support while on maternity leave. The fact that the educator had to take some of their maternity leave unpaid made assisting with grading tasks during leave that much harder to swallow. "So, the [district] only allow you to save up fifty sick days. Even if you could save that many days for maternity leave, it doesn't cover a full 12 weeks of maternity leave, because that would take 60 days," the teacher illustrates. And their frustrations did not end with maternity leave

itself, the transition back did not go any smoother with a drastically lower monthly salary, no sick days left to care for ill children, and no designated pumping space in the building.

Another educator shared a similar sediment even though they had not started to build a family yet, "I felt like I couldn't ever be sick because I needed to save every day for when I'm pregnant." To the participant, it seemed unlikely that they could stockpile the days for a fully paid maternity leave. They found the system of borrowing sick days from the next year to cover a current maternity a poor system, because it only "kicks the can" of not having enough days for the next baby's maternity leave. They said, "you end up having money taken from you to have a baby" just because you want your kids less than four or five years apart. Also, the teacher did not like trying to schedule their pregnancy around the school calendar because fertility issues made this next to impossible. So, they made the decision to leave education before having a baby because they wanted a longer maternity, less stress preparing for leave, and to not take a financial hit while on leave.

Sick Days. Two out of eleven participants reference sick days in regard to paid time off. With a code frequency of nine, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One resolved that they hated having to write substitute plans and this factored into their decision-making for a new job, "I was looking for a new job, I wanted to be able to take time off when I wanted without having to create sub plans." This teacher continues, "I would rather go to work sick than be gone. 100%, that's what it came down to. I don't care if I'm sick, I'd rather go to work than take a sick day." Another educator found it next to impossible to take a day off when teaching, "which only amplified feelings of burnout."

They expounded that the stress that goes into writing detailed substitute plans took so much time and energy, and it hardly felt worth taking a day off, "I'm working 2 hours to be gone for 8 hours." Teachers described the ease of being sick or having ill children in their new positions. One stated that all they have to do is, "put my out-of-office reply on." Another expressed gratitude in their new position's stance on sick days, "this is one of the best work-life balances in terms of unlimited time off and holidays are still time off. I can run my kid to the doctor, and I don't take time off."

Personal Days. Two out of eleven participants reference personal days in regard to paid time off. With a code frequency of three, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator stated that teachers should just have general days off and get rid of the personal day and sick day structure. Another teacher found it ridiculous that teachers have to use their personal days to attend professional development conferences. And they continued that it is next to impossible to even take a personal day with the substitute shortages because a personal day has to be preapproved and substitute coverage confirmed.

Bereavement. One out of eleven participants reference bereavement in regard to paid time off. With a code frequency of one, participant responses have been pared down to the following summary capturing the key ideas. One participant viewed the limited bereavement days to be a real hindrance to mental health. They clarified that teachers only get so many bereavement days, and if you have a difficult year and lose more than one family member or friend, you are not given the time you need to properly heal.

Scheduled Breaks. Three out of eleven participants reference scheduled breaks in regard to paid time off. With a code frequency of three, participant responses have been

pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator misses having the teacher schedule, so their days off coincide with their children. Other teachers anticipated the loss of scheduled breaks to be a bigger adjustment, yet "I don't actually miss it like I thought I would." One person stated, "you don't need a break in the summer, you need a break in October, you know, because you're burned out in October and there's no time for you to do it in October." They find that their current position allows them to recharge when it is needed rather than a forced break schedule. A different educator enjoys getting to go on vacation with their family when it is affordable, which makes for a fuller life.

Professional Development. Seven out of eleven participants reference professional development with a code frequency of twenty-five. Within the subtheme professional development, three major categories appeared (not in density order): value; time barriers; and professional development outside of the district. The codebook definition for professional development was experiences that are intentionally designed to expand educators' skills and knowledge related to instruction, curriculum, and educational practices.

Value of Professional Development. Six out of eleven participants reference the value of professional development. With a code frequency of fifteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. The educators that established value in professional development described gaining a greater understanding of complex teaching assignments. One teacher explained that excellent professional development has a clear objective with a goal or desired outcome. Another person noticed their professional development provided a

"wide breadth of skills" and they felt growth both personally and professionally.

Other teachers perceived professional development as hit or miss. One educator stated, "I'm not looking for definitions or content cut and pasted from a book. I'm looking for content, actual tools that I can use in my classroom to make me a better teacher." Professional development was sure to flop if it was just extra work time, where a person said they would just check their email and lesson plan because they wanted to collaborate with colleagues and that was not happening. Another teacher felt frustrated when professional development lacked direction and felt random, they explained, "most times I would say professional development days are a waste of time, if the [administration] is setting them up." A different educator found online professional development to be ineffective because it never got them thinking outside of the box, the only benefit they saw to online professional development was being self-paced and completed at the teacher's convenience.

Time Barriers. One out of eleven participants reference time barriers in receiving professional development (PD). With a code frequency of seven, the participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One teacher wanted more professional development, yet this was hard, because the participant had to make the decision to give up their personal time because professional development was not embedded into the workday. Another educator desired to observe colleagues teaching; however, it was difficult to execute giving up a plan time. Also, they would lose time before or after school to debrief their observations with the classroom teacher. A different educator confirmed that between giving up personal time to participate in professional development, and the inability to get a

substitute to attend professional development meetings, created a lot of unnecessary obstacles in growing as a professional.

 Professional Development Outside of the District. Two out of eleven participants reference professional development outside of the district. With a code frequency of three, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One educator found that some of the best PD they had received came from attending national conferences, yet these types of conferences are unpaid for the teacher. The teacher thought it was worth it because it "was fantastic to be around other like-minded people." In their rural community, a person really enjoyed the Educational Service Unit (ESU) provided professional development. They liked being able to go out and seek the professional development they found valuable, and then the district "had money to send teachers to get PD" so it was perfect.

 In closure, district level systems directly influence STEM teacher attrition rates by shaping the overall work environment and teacher satisfaction. Competitive salary and benefits packages play a pivotal role in retaining STEM educators by recognizing their expertise and commitment. Although many participants did not reference an increase in salary as a motivator to leave, they do mention not returning to the classroom without receiving equitable compensation. Moreover, targeted professional development opportunities not only enhance instructional quality but also foster a sense of professional growth and investment, thereby mitigating attrition. Additionally, the provision of adequate paid time off, such as sick days, maternity leave, and personal days, demonstrates institutional support for teachers' well-being and work-life balance, ultimately reducing burnout and turnover within the STEM teaching workforce. The

participants that referenced maternity leave systems displayed emotions of dissatisfaction and disenchantment with the lack of support during a major transition in life. For two teachers, maternity leave systems are the main factor inhibiting them from returning to the classroom. Collectively, these factors underscore the multifaceted approach necessary for addressing STEM teacher attrition and sustaining a high-quality educational workforce.

District Level Support Structures

The codebook definition for district level of support structures is systems and procedures for interpersonal relations between the district, staff, students, and community. The following major subthemes for district level support structures, in code density and frequency order, board of education and district level support structures; administrative support and advancement structures; building support structures; district and community support structures; and student support processes.

Board of Education and District Level Support Structures. Four out of eleven participants reference the board of education and district's general level support structures, with a code frequency of eighteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. A teacher described having a district that had great support, "I think what [district name] does really well is their support [of teachers]." This same educator stated they understood the complexity of decision making at the top and wanted to know that district leadership cared enough to make a change to better support teachers. They wanted to know that district leaders were doing things to help teachers out.

Another teacher desired clear systems and protocol for regular life events, such as, going onto maternity leave, long term substitutes, and returning from leave/pumping. They thought a district created binder could function as a resource to assist both principals and staff navigate these expectations which would help keep it consistent and within legal requirements. Another educator felt like the district could establish better systems of support enabling employees to have adequate days banked for a full maternity leave, so they would not be forced to go onto Family and Medical Leave Act (FMLA). They thought current practices added additional hurdles and obstacles to having a child because getting ten banked days a year, only allows for a paid maternity leave every 5 years (and that is with 2 weeks unpaid, and no sick days taken in between). They found this to be unrealistic and unnecessary.

Other teachers described being disenchanted with decision-making processes. One educator elucidated that the school board was so "concerned with staying in power and re-election" that everyone turns into "yes-man" in which there was an absence of fruitful dialogue at the top, creating gaps in support structures and systems. This teacher specifically referenced support systems are lacking at the district level to properly and quickly respond to issues related to alcohol and sexual assault. A different person found systems of support to be unclear and constantly changing during COVID-19 which impacted the educator emotionally and mentally. Another participant felt a lack of control, stating, "changes made at the district level, we just felt like we didn't have any control over, you know, didn't have any say, I guess." One teacher found it hard to continue to be "a part of a system that is broken." They felt that by staying in teaching, they were sending the message that everything will work itself out. They explained, "I

needed to leave to show my dissatisfaction with the educational system at large."

Administrative Support and Advancement Structures. Two out of eleven participants reference administrative support and advancement structures, with a code frequency of fifteen, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. The processes for which administrators are recruited, hired, supported, and held accountable throughout their career.

Entry into Administration. One educator explained that there is not a high enough bar to get into administration because the entry requirements do not ensure success, "because you've taken 18 credits, have a track record, taught X number of years – and you can suddenly make decisions?" Another participant sat on hiring committees for teachers and administrators, "in those hiring committees, I would get, you know, whiffs of, well this person is … being a little groomed … to go into administration," and thoughts surfaced like, "is this in the best interest of the individual who has risen to the surface?" A different educator thought there was a mold for what the district was looking for in administrators, and "if you did not fit the mold, you would not be promoted." This teacher explained that this systematic way of promotion leads to thinking inside a fixed box. While another person observed others get nudged into leadership because, "they're one of the good old boys and they're part of the culture, whereby, they're part of this group that goes out and drinks and they're always at sporting events together. You know, I'm not trying to throw stereotypes. I'm just trying to give examples of things that I've seen." Another educator made a similar observation about gym or work out buddies among teachers and administrators, "all these principals started going to specific gym or

workout to get into the good old boys' club." They saw that if individuals did these things with leadership, then they were privy to certain information.

One teacher had a new administrator who kept hiring people that were their administrator's buddies and a part of the good old boys' club. They recounted, "then the next [assistant principal] that came in, also, a good old boy" who allegedly had an affair with another staff member in his former building, and he still got to be an administrator because he was a part of the club and that protected him from his actions." One concluded, they became knowns as the "three amigos and it wasn't good."

Administrator Accountability. A couple of participants witnessed inefficient leaders alienating staff, having a closed door, not listening to staff concerns/ideas, having an absence of strategic leadership, and would mistreat their staff. One teacher thought,

We just have to figure out a way, systematically, for all of the components of the power structure to be effective checks and balances on each other. And when you get everybody in a system who is incapable of questioning leadership because leadership is in a self-reinforcing, self-protective cycle, you're in trouble. You're in serious trouble. Now, I mean, I think that is what happened …

This same participant wanted administrators to have an interpersonal rubric evaluated annually to assist with these checks and balances. Lastly, one educator explained, "the leadership did have a lot to do with it, that's one if the reasons why I left at that time."

Building Support Structures. Five out of eleven participants reference building support structures, with a code frequency of nine, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. Under

the current system, paraprofessionals and special education paraprofessionals are not making enough to be retained, one teacher recognized. When a classroom is short staffed a paraprofessional, the teacher is left to both educate an entire classroom and deal with the significant needs of individual children. They continued, when you consider the amount of trauma kids have experienced and the implications of this on their learning and behavior, a lack of support is destroying classrooms. The educator witnessed resource teachers being physically attacked by students because they did not have the proper supports and paraprofessionals in the classroom.

Another teacher requested consistent district-wide building systems that the administration would hold accountable in order to better support the work of teachers in the classroom. For example, this educator desired a building-wide cell phone policy, "phones are always a huge issue. Our building would never implement a building-wide policy. So, it was really hard to say put your phones away when you know the person next door doesn't care if they have them." They continued they "had asked several times for an umbrella rule… nothing ever happened."

A different educator wanted district systems of support to respond to low performing teachers. They found that in the current system, it is easier to push the teacher into a less desired class, teaching easier courses, than to actually deal with the issue at hand. "Some of the worst teachers in our building, taught the low-level classes because that was [administration's] solution."

Student Support Processes. Three of the eleven participants reference student support processes, with a code frequency of five, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One

educator highlighted a need for more equitable systems of support for diverse student populations. They desired structures that allow all students to have access to programming that would promote the highest level of knowledge and success, no matter the students' background. Another teacher wanted stronger student support processes to respond to student mental health concerns.

District and Community Support Structures. One of the eleven participants reference district and community support structures, with a code frequency of six, participant responses have been pared down to the following quotes, paraphrases, and summaries capturing the key ideas. One participant reveals that there are a lot of political interactions that happen at the top of school districts, "every district in the United States is on a sliding scale of [high] corruption to taking a strong stance against unethical donor practices in schools. And [resident city] exists somewhere in the middle there." They add, "between school board members and superintendents and public donors and central office administrators, I was essentially in a situation where anybody in power, who could have been a check against the practices, however, it wasn't safe for them to question the practices." They did not see an option to question the relationship ties between the district and community, "so, from day one in [resident city], I saw the influence of people wielding money and impacting decision making." The educator elaborated, "I can give you an example, a donor comes into the school and doesn't like the color of the walls, so they contribute thousands of dollars to change the color of the walls during a pandemic." The teacher provides another example of, "hey, my kid plays golf for you. Can I contribute $350,000 to build a [sports] facility? … That will benefit seven students a year … then the messaging is look at how proud we are of our new [sports] facility." So, the

participant explains, "money is being thrown around" districts. They observed that, "[resident city's] business center really struggles with the idea that you can't just purchase access. Purchasing access is unethical and a serious problem."

In closure, district level support structures had the lowest comment density and frequency. Even so, this section became a main theme because of the level passion participants had when discussing broader district support structures. Overall, the comments had a more negative tone that reflected specific and unique instances of displeasure by the participant. For example, one participant's experiences with district and community support structures became the largest factor in their attrition from the classroom due to feelings of disenchantment and disillusionment related to their impressions of an imbalance of power structures within district level support structures.

Participants Perception of Returning to the Classroom

The majority of participants have no intentions of returning to the STEM classroom citing a heavy workload that created a poor work-life balance and the need for a competitive salary as their rationales. Only one educator explained that they are "seriously considering returning to the classroom" because they desire a teacher's schedule which allows for them to have more time with their children. Conversely, two other educators stated returning to teaching is "not off the table but just not anytime soon," with the reason for delay being a need for flexibility with their young or growing family.

Chapter 5

Discussion

The purpose of this qualitative study was to analyze the turnover patterns of eleven former Nebraska STEM teachers. The research described the influences that impact Nebraska STEM teacher attrition. The results from these semi-structured case study interviews provide academic merit to the field of education by supplying data to key decision-makers to inform policies and procedures. Furthermore, it benefits the field by educating various stakeholders on elements that are associated with STEM teacher attrition to improve conditions and mitigate high turnover rates.

This chapter will provide an elucidation of the results in the form of implications, discussions, and recommendations. The inferences will be based on the highest saturation of participant responses related to conditions of attrition, along with the frequency of comments related to a specific factor spanning all case study interviews. It should be noted that none of these factors take place in silos, so there is a level of interconnectedness in the themes of attrition. The major theme will be included along with any subcomponents that play a crucial role in attrition.

One of the biggest examples of this is the interrelation between career satisfaction and career dissatisfaction because of the complex interplay of factors influencing individuals' professional fulfillment and discontent. As shown in Figure 7, the author changed the initial framework because it missed this crucial component of recognizing that a teacher's perceptions of their job can simultaneously reside on two sides of the same coin, career satisfaction and career dissatisfaction. A STEM teachers' lens of

specific job conditions will shift as they progress through their career and will remain
fluid until they exit the profession. These feelings of career satisfaction and
dissatisfaction can occur at the same time, such as an educator's perception of the teacher
schedule, they may emphasize joy because of summers off with their children and
discontentment when needing to use a sick day for a doctor's appointment. This constant
tension between career satisfaction and dissatisfaction is expected until a large imbalance
occurs, and the educator's comments of dissatisfaction greatly outweigh career
satisfaction which ultimately motivates them to leave the classroom.

Figure 7

STEM Teacher Attrition Conceptual Framework, Modified with Career Satisfaction and

Career Dissatisfaction
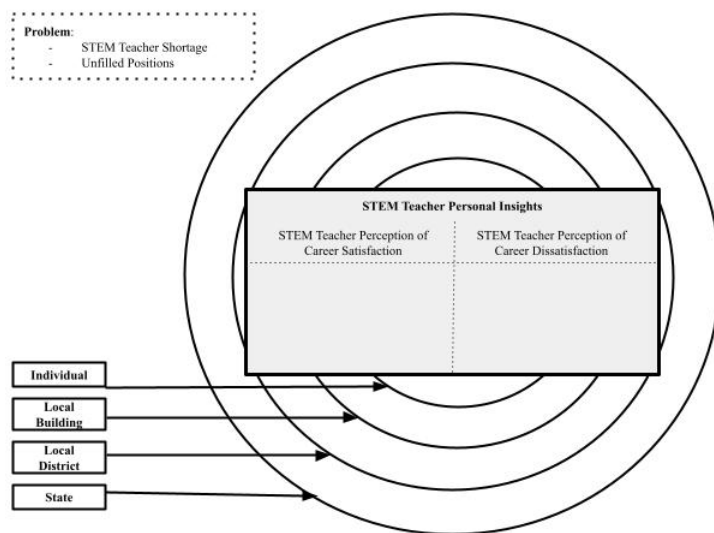
Implications

The two most saturated codes within the case study data set were, first, STEM
Teacher Career Dissatisfaction and, second, STEM Teacher Career Satisfaction. This
study analyzed influences in attrition, STEM Teacher Career Satisfaction was not
scrutinized beyond the mention that STEM teachers find a tremendous amount joy in

helping, guiding, and impacting students. Additionally, participants value inspiring learners and improving their academic outcomes. These elements are expanded upon in the discussion section regarding elevating positive teaching experiences in order to decrease attrition rates.

Career Dissatisfaction

When combining all eleven case study interviews and analyzing recurrence of topics mentioned, career dissatisfaction is mentioned by all participants and its code frequency is three times more than the next attrition theme of administrative tasks of leadership. For many participants, the feeling of career dissatisfaction prompted the journey out of the classroom. For the few who did not reference career dissatisfaction as part of their impetus for transitioning into a new job, they do highlight a component of it when explaining why they choose to not return to teaching. When unpacking the elements of career dissatisfaction, one finds a lack of accomplishment, a work-life imbalance, and feelings of burnout.

All eleven participants referenced experiencing a lack of accomplishment as a classroom teacher. With an absence of achievement in impacting students as their primary concern, teachers referenced an inability to improve student behavior or make strides in student academic growth. Because the most frequently mentioned component of career satisfaction came from helping, guiding, and impacting students, it follows that teachers experience a lack of accomplishment when they are unable to reach all students. There was a concurrence between lack of accomplishment and student behavior. The interrelation between these codes either occurred when an educator was unable to effectively teach the entire class due to distractions from student behavior or they were

unable to impact the student misbehaving. When discussing student behavior, participants did not take issue with the individual student. The teachers were able to separate the student from their actions and the behavior source. The lack of accomplishment came from an inability to help, reach, change, and improve student behavior.

In addition to a lack of accomplishment, all but one participant referenced a work-life imbalance impacting their career satisfaction. Teachers felt unable to reduce the overflow of work which had a direct impact on their ability to create equilibrium in and outside of the classroom. Educators referenced having to sacrifice their evenings and weekends in order to complete all necessary work tasks. One participant referenced implied job requirements that get piled onto a teacher. Even if a teacher ignores some of their teacher tasks, in pursuit of a healthy work-life balance, they cannot escape feeling a lack of accomplishment from not meeting unrealistic performance expectations. And, when many participants described their workload, they highlighted a gradual change in expectations overtime. A couple educators specifically referenced a proportional relationship between increasing class sizes and the amount of work. This theme co-occurrence exposes the relationship between work-life balance, workload, and class sizes. This is because larger classes require more grading, parent communication, and differentiation in lesson planning which take time to accomplish.

Based upon the teacher's shared narratives, feelings of a lack of accomplishment and a work-life imbalance lead to feelings of burnout. Nine out of eleven participants experienced feelings of burnout that impacted aspects of their physical, mental, and/or emotional well-being. Three different teachers shared how their spouses mentioned major changes in their mood and demeanor at home within months of leaving the classroom.

One educator needed to pause for a moment after sharing that her spouse had "questioned their marriage" because of how their disposition changed during their last few years of teaching. After collecting their thoughts, they described how improved their life has become post-teaching. Another educator references "feeling lighter" and not having "nagging anxiety hovering over them 24/7."

Administration

For better or for worse, participants' perceptions of their administrator were a factor in STEM teacher attrition. One participant knew their principal had cultivated a "unique and special place" to work, which they knew could not be easily replicated. This participant deliberated staying or leaving because of this experience with administration. Four other educators reference their administrator encouraging, mentoring, and developing them professionally which ultimately aided them as they transitioned into building or district leadership positions. The remaining six out of eleven participants had bleak narratives to share about their former administrators. Other administration themes that appeared were administrator dispositions, administrative supports, and advancement structures. Furthermore, administration continued to appear in categories related to student behavior, school climate, leadership and voice, and parental support.

It was these participants who used the following words to describe their administrator's persona: ego, power, misogynistic, bully, unprepared, uninformed, amoral, unethical, unsupportive, spineless, good ole' boys, and harmful. These words carry a heavy blow and foreshadow the experiences that some participants encountered during their time as a classroom teacher. One educator explained that their administrator had the district office fooled by creating "a smoke and mirrors effect. Sell the people on

you as a person, but your leadership is actually terrible."

Overall, these participants desired a leader who would develop them as an educator. One referenced that care comes in the form of providing constructive feedback, in areas of both success and needed growth. Others wanted curricular growth and support from their administrator, and wished the administrator would have provided them with more resources. Multiple teachers wanted their administrator's support when handling student behavior and parent communication. One teacher highlighted how seriously they took parents entrusting them with their children, "it's not a task to take lightly." This participant felt slighted by their administrator when they demanded they extend deadlines or give the student a grade after cheating on a test. These actions caused the educator to feel undervalued and unsupported.

Presence within the building became a common theme when participants discussed how their former administrator could have improved. Due to a lack of visibility in the building, a teacher referenced how the principal never upheld rules, had zero accountability, no pulse for the climate of the school, and never built relationships with staff. Multiple participants wanted an administrator that walked the halls, had regular check-ins with staff, advocated for teachers, celebrated good work, and ensured that building regulations were being followed.

Discussion

Although STEM teacher attrition is influenced by an individual career decision, the research results indicate that other factors can either improve or diminish career satisfaction. To impact STEM teacher turnover patterns, it is essential to grow the good

and reduce the roadblocks to retain highly qualified educators. Teachers are not isolated, and their working conditions are impacted by numerous outside factors like their building, district, and state.

After conducting the case study analysis, the initial STEM Teacher Attrition Conceptual Framework (see Figures 2 and 3) needed adjustment. As shown in Figure 8, elements with low frequency of occurrence have been eliminated while others have been added. For example, the national level was completely removed due to no reference of national accountability measures, the national workforce, and national teacher vacancies. Although these factors do trickle down and impact states, districts, and buildings, teachers do not mention these elements directly impacting their career satisfaction or attrition. Case study participants saturated topics related to local levels of control to the point that this needed to be separated into local building and local district.

Each level of control influences teacher attrition rates by either expanding upon positive practices that increase career satisfaction or reducing conditions attributed to teacher attrition. Additionally, certain elements have been colored green for growth and red for reduction in order to improve STEM teacher turnover patterns. There are actionable items that can be implemented to increase a teacher's career satisfaction. These recommendations originate from blending participant responses with established research in the field. All recommendations for growing the good and reducing the roadblocks can improve working conditions for all teachers, not just STEM educators. The items that remain black cannot be modified, such as administrator dispositions and parental support, but impact teacher career satisfaction; however, they require adjusting behaviors of individuals which is beyond the scope of this discussion.

Even with modifications, limitations remain within the framework. This framework does not represent the role of a teacher's locus of control, teacher efficacy, and how situations in a teacher's personal life may impact their perception of work satisfaction. The current framework does not allow for saturated comments to be properly teased out and analyzed, such as comments related to administration. It is difficult to examine the varying degrees of comments from praising administrators to that of placing blame.

Figure 8

STEM Teacher Attrition Conceptual Framework, Modified with Results
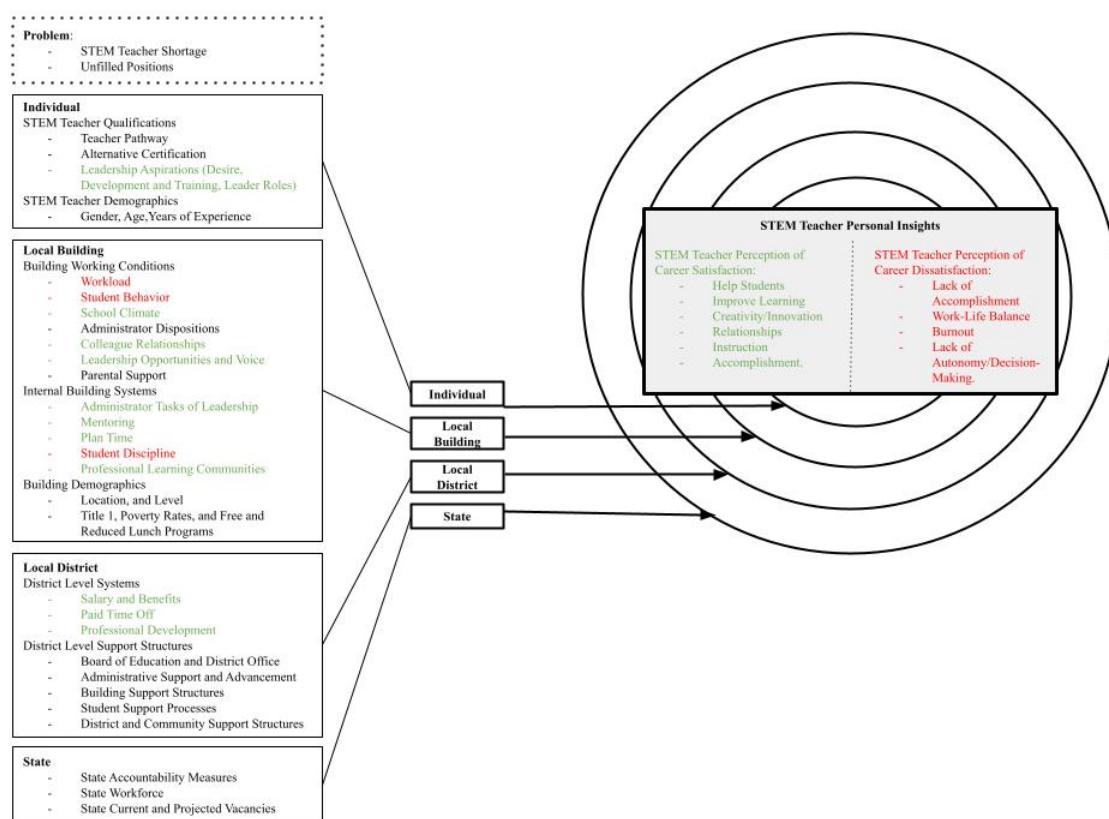
Grow the Good

Factors within the building, district, or state levels of control that may positively impact STEM teacher career satisfaction are instituting mentorship, creating

opportunities for team building, and extending plan time while implementing

professional learning communities.

Local Building Level. Recommendations for change within the local building

level of control.

Mentoring → *Instruction and Accomplishment*. There are two areas in which

mentorship can be expanded. First, mentoring associated with induction processes and,

second, mentorship for seasoned educators looking to grow professionally through

introspection and scaffolded support (Parker et al., 2021). In both instances, participant

responses indicate a need for intentional partnerships considering the strengths of both

the mentee and mentor. Mentorship is not a box checking process and both individuals

must be invested in the development of the profession (Sutcher et al., 2019). The

byproduct of fruitful mentorship programs is an increased sense of accomplishment for

the mentee and mentor along with improvement in instruction (Henry et al., 2012), both

of which increase teacher job satisfaction.

Team Building → *Colleague Relationships* → *School Climate*. With mounting

workloads, many participants reference the reduction of team building activities

occurring in their workplace. These teambuilding activities provided an outlet to blow off

steam from the pressures of the job, build relationships with colleagues, and ultimately

improve the school climate (Brantlinger, 2021). By investing time in people, building

administrators create a foundation for workplace friendships which diminishes feelings of

isolation and discontent (Ndoye et al., 2010). When teachers have supportive colleagues,

they are more likely to take risks and stretch outside of their comfort zone (Johnson et al.,

2012). When colleagues have relationships rooted in trust and respect, they feel inspired

and encouraged by fellow teachers.

Hallway conversations and chats during teacher plan are not wasted time but necessary for a positive work environment. When teachers are burdened with a heavy workload, the easiest thing to cut is connections. The temptation to close one's door and knock items off ever growing to-do list creates a cycle that does not honor the power of relationships (Sirota et al., 2005). To-do lists will persist because new items replace the accomplished ones; however, as participants mentioned, having close relationships with colleagues at work makes it very difficult to leave, even with an overwhelming workload (Geiger & Pivovarova, 2018). When these relationships dissolve and just work is left, educators find employers with potentially better workloads, i.e., shorter to-do lists. And yet, even now, many of these former teachers cherish the fond memories of connections with colleagues and students. Relationships are not optional; they are important enough to prioritize.

Plan Time → PLC → Creativity and Innovation. Common themes across all participants includes an overwhelming workload that required them to work outside of contractual hours. Educators referenced feelings of inadequacy associated with completing job related tasks due to limited plan time. Research affirms these participant perceptions that increasing plan time provides teachers the ability to fulfill their job requirements, which positively impacts their job satisfaction (Thornton et al., 2008). Coupling additional plan time with professional learning communities (PLCs) amplifies teacher productivity by establishing common instructional goals that are developed and strategically addressed in a collaborative partnership (Sass et al., 2012). This consistent PLC support network provides a place for teachers to think outside of the box and

institute creative and innovative instructional strategies which positively impact student academic achievements and motivations to learn.

Local District Level. Recommendations for change within the local district level of control.

Salary and Benefits → Sense of Value. According to research and participant responses, improving working conditions is a larger indicator for reducing attrition rates than salary and benefits, which means that increasing teacher salaries is only one small aspect of retaining high quality STEM teachers (Djonko-Moore, 2016). A salary increase improves the sense of value and provides a level of prestige for the field of education (Kraft & Lyons, 2022). Furthermore, revamping teacher salaries could open the door for teachers who left to return to the classroom (Hanushek & Rivkin, 2004). According to the study results, teachers who have left the classroom would consider returning if teacher salaries became more competitive with their non-teacher pay. Lastly, one participant mentioned finding avenues to pay teacher/peer leaders more stating, "we cannot only give pay raises for people going into administration because we are losing good classroom teachers then."

Teacher Leader Pathways → Leadership and Voice. Another avenue to enhance teacher career satisfaction, while also honoring their desire to positively influence education, is to increase teacher leader opportunities that do not remove educators from the classroom (Ndoye et al., 2010). Many districts have invested in their staff through professional development and coupled with teachers' pursuits of master's degrees in education, districts now have highly engaged, knowledgeable, and eager teacher leaders looking for an opportunity to expand their impact outside of the classroom (Garcia et al.,

2022). As one participant referenced, there is a delicate balance between offering time and talents to one's district and experiencing an overwhelming workload due to teacher leader responsibilities and classroom tasks. It is important for districts to create the time and space for teachers to lead without compromising their time in the classroom, along with recognizing their talents with adequate compensation (Ondrich et al., 2008).

Professional Development → Inspire Students and Improve Student Academics. When professional development is executed well, participants referenced feelings of satisfaction because they grew as a professional and could see a direct impact for improving student outcomes in their classroom (Kersaint et al., 2007). Participants found the most value in professional development that was self-selected, such as, attending state or national conferences. Many districts have ceased providing funding for teachers to attend professional conferences and workshops because of budget reductions. Based on research and participant responses, districts should fund opportunities through their regular budget or grants to encourage and promote professional development (Nguyen et al., 2020). By partaking in effective professional development, teachers have a greater sense of accomplishment in their ability to inspire students and improve academic achievements (Sass et al., 2012).

State Level. Recommendations for change within the state level of control.

Teacher Education Programs → Increase Accomplishment. According to research and the shared experiences of multiple participants, the ability to appropriately manage student behavior in class has an impact on their feelings of accomplishment and career satisfaction. The largest hurdles in classroom management happen during an educator's early career (Vagi et al., 2019). Although most participants left education mid-

career, they referenced being underprepared to handle the realities of the classroom. One participant specifically spoke to wishing their teacher education program provided more classroom management techniques to prevent the sink-or-swim dynamic that occurred at the start of their career. When teacher education programs intentionally develop and improve techniques to reach all learners, teachers are able to experience manageable student behavior which increases their feelings of success in their abilities to positively impact student growth (Henry et al., 2012).

Reduce the Roadblocks

Certain elements impacting teacher turnover may be too complex to fully change; however, a change in one of the interconnected components could make larger factors for attrition more tolerable. The following are recommendations to decrease factors that cause teacher dissatisfaction.

Local Building Level. Recommendations for change within the local building level of control.

Increase Administrator Effectiveness → Working Conditions. The power of an effective administrator is far reaching (Johnson et al., 2012). A talented administrator excels at teacher growth and development, addresses student and parent concerns, is supportive and visible, and creates positive working conditions for their staff (Geiger & Pivovarova, 2018). One participant, who exited a building with a "toxic administrator" described a need for an interpersonal administrative rubric to assess the effectiveness of leader's ability to foster success in their building (King Rice, 2010). Another participant referenced an assistant principal that was underprepared when they transitioned into

leadership. Creating support systems for struggling administrators would allow leaders to receive professional development addressing the specific areas of defect they are experiencing.

Addressing Student Behaviors → Feelings of Accomplishment. In case study interviews, participants referenced how classroom behaviors impacted their ability to effectively educate and meet the individual needs of students. Multiple participants cited how a handful of students can dominate their attention causing them to have feelings of dissatisfaction (Thornton et al., 2008). To make matters worse, teachers experienced a lack of support from their administrators to respond to student behaviors. A couple of teachers referenced the office being a juice and snack stop for some kids. To minimize this roadblock, buildings can establish a clear response system for student behaviors that warrant administrative support, along with a tiered behavior response system to coach, develop, and improve student behaviors (Grant & Brantlinger, 2022). In buildings with a high frequency of negative student behavior, it would be beneficial to bring in a behavioral specialist to provide strategies to classroom teachers for addressing and managing students. This professional development would focus on proactive approaches to manage behavior, along with strategies to motivate and engage learners (Ingersoll, 2011). Additionally, administrators could benefit from training focused on responding to student behavior and responding to parental concerns (Kersaint et al., 2007).

Boundaries and Advocacy → Work-Life Balance. Most participants referenced feelings of burnout related to an unrealistic workload. Teacher workloads are increasing due to factors such as larger class sizes, expanding administrative duties, evolving curriculum demands, and limited time, placing greater strain on educators to meet the

diverse needs of their students. Madigan and Kim's (2021) research confirm that it is common for teachers 10-12 years into their career to feel heightened levels of burnout and career dissatisfaction. One participant, who is now an administrator, described how they encourage work-life balance by coaching their teachers on establishing boundaries and advocating for their personal and professional needs. Other research elaborates that teachers can create boundaries for better work-life balance by setting clear limits on work hours, prioritizing tasks, delegating when possible, practicing self-care strategies, and communicating effectively with colleagues and supervisors about their needs (Nguyen et al., 2020). One participant that is now a building administrator encourages their staff to go home at a reasonable time by rounding the building and letting teachers know the work can wait until the next day, thereby putting limits on the workload. Another participant, who is now an administrator, described encouraging staff to take mental health days if they felt overwhelmed or burned out. Although it may be difficult to reduce the workload placed on teachers, administrators can help employees prioritize tasks and highlight the importance of taking time for themselves and their family which lays the foundation for better work-life balance.

Local District Level. Recommendations for change within the local district level of control.

Deliberative Decisions Regarding the Impact of Initiatives → Workload.
Education is an ever-changing institution. Districts that aspire to lead in instructional strategies, academic rigor, and developing college and career ready students will stay current on new educational practices and advancements in technology. The byproduct can be positive for student learners, and yet, can be detrimental to a teacher's workload. As

districts make decisions surrounding new initiatives, they must be deliberative in what is determined worthy of teachers' time and district resources (Carver-Thomas & Darling-Hammond, 2019). Essential conversations are needed surrounding the driving mission and vision for the school and student learning. If teachers are being asked to complete tasks that do not align, and create unnecessary burdens or stress, these job elements should be eliminated (Madigan & Kim, 2021). For example, a participant referenced the need to create and maintain a website for their classroom. They found the website creation overwhelming, time consuming, and it did not have any positive outcomes for student learning in their classrooms. The teacher felt confident that not even the parents visited their website, they felt like it was a teacher requirement that served no greater purpose.

Paid Time Off (PTO) → Decrease Burnout. Paid time off (PTO) is an essential component in combating burnout among teachers. With the current workload, educators feel constant pressure to perform which can lead to high levels of stress and exhaustion (Sirota et al., 2005). General PTO, without the designation of needing to be sick, provides teachers with the opportunity to rest, recharge, and rejuvenate both mentally and physically. Without the ability to take time off, educators may experience diminishing productivity, decreased job satisfaction, and heightened levels of burnout (Kraft & Lyon, 2022). By offering PTO, districts not only demonstrate their commitment to teacher well-being but also foster a healthier and more productive work culture. Overall, investing in paid time off can lead to higher employee retention rates, improved morale, and greater organizational success (Ondrich et al., 2008).

This extends to maternity leave as well. As one participant found, only allowing

teachers to bank 50 sick days meant, at best, they could only have 10 weeks of paid maternity leave assuming no other sick days are used for other events. By offering paid maternity leave, districts demonstrate their commitment to employee well-being, which can lead to higher retention rates and lower turnover costs overall (Kersaint et al., 2007).

State Level. Recommendations for change within the state level of control.

State Accountability Assessments → Help, Grow, Improve Students. Enhancing state accountability assessments is crucial for providing valuable insights into student learning, and subsequently informing targeted teacher instruction (Mehta, 2013). By incorporating more nuanced and real-world application questions, embracing diverse assessment formats, and ensuring timely feedback, these improvements can foster a more accurate reflection of students' abilities, ultimately empowering educators to tailor their teaching methods more effectively to address individual needs (Brantlinger, 2021). These changes would address participant concerns regarding assessment data being unusable and not relevant in the daily instruction of students.

Considerations for Future Research

Future research can investigate the interdependence between working conditions and job satisfaction. To expand the body of knowledge regarding STEM teacher attrition, there is a need to compare STEM teacher and non-STEM teacher attrition patterns. To better inform Nebraska policies surrounding recruitment, retention, mobility, and attrition rates, it is advantageous to study trends in STEM teacher attrition over time using the Nebraska specific data sets. Lastly, to better understand the relationship between teacher career satisfaction and dissatisfaction, a large-scale survey should be designed and

administered to analyze trend data related to teacher perceptions on why an educator chooses to leave or stay in the profession.

Conclusion

In conclusion, the issue of STEM teacher attrition demands urgent attention and multifaceted solutions. When navigating the complexities of educational landscapes, it is imperative to recognize that the departure of STEM educators signifies more than just a loss of personnel; it reflects systemic challenges that jeopardize the future of scientific literacy and innovation. At some point, everyone will retire, move, or be promoted out of the classroom and it is natural and normal to transition to the next best thing. What must be addressed is an educator's career ending prematurely due to dissatisfaction, where it becomes easier to move on than to continue teaching. It is especially worrisome when leaving teachers mention feelings of investment and value in educating students, yet do not find the working conditions bearable, as one participant shared,

> I get a lot of comments from people like, oh, you left. Did you not like it? I'm like, no, I didn't just like it, I actually loved it. I'm having a really hard time not having that. I just couldn't. You know, I had to make the choice of where my energy is gonna go. And I couldn't handle it anymore. That's what it came down to for me.

By fostering supportive environments, implementing targeted professional development initiatives, and advocating for policy reforms, one can turn the tide of attrition and cultivate a thriving community of STEM educators dedicated to inspiring the next generation of thinkers, innovators, and problem solvers. The journey towards

sustainable retention is arduous, but it is one that can be addressed through targeted responses at individual, local building, local district, and state levels of control in order to demonstrate an unwavering commitment to collective action for the betterment of society as a whole.

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