Experiences That Supported or Hindered Female K-12 Chief Technology Officers

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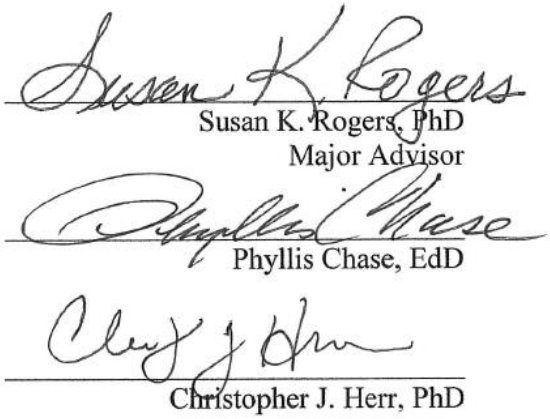

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Abstract

Females comprise the majority of K-12 educators nationwide, but only one-third of all K-12 chief technology officers (CTOs) are women (Consortium for School Networking [CoSN], 2023). Female CTOs earn lower salaries (CoSN, 2023) and hold less prestigious titles (CoSN, 2017) than their male counterparts despite having more advanced degrees and more years of experience than male CTOs (CoSN, 2017). In 2024, little research was found on female CTOs, specifically research that investigated the supports and hindrances experienced by female K-12 CTOs. The purpose of this qualitative study was to explore the experiences of female K-12 EdTech leaders and discover who or what supported or hindered their pursuit or fulfillment of the responsibilities of a CTO position. Through interviews with 13 current or recently retired female K-12 CTOs from across the United States, the researcher identified seven major findings that emerged from their responses:

1. Professional networks were reported to be the most impactful external support.
2. Leadership was both a support and a hindrance.
3. Sexism and bias were the most impactful external hindrances.
4. Self-efficacy and a growth mindset helped participants mitigate internal hindrances.
5. Family support was vital.
6. Work-life balance was a common struggle.
7. Lack of representation was a common hindrance, and underrepresentation was viewed differently by women of color and White women.

The implications of this study include building upon supportive professional networks like CoSN, supporting aspiring female CTOs to develop their skills and access to leadership positions, providing multifaceted support for current female CTOs, and providing opportunities for male CTOs and district administrators to serve as change agents. Recommendations for future study include an exploration of female CTOs' career experiences targeted toward their pursuit of a CTO position, how CoSN members' experiences differ from CTOs who are not members of CoSN, how sexism and other biases like racism and heterosexism impact female and male CTOs, how mentoring can be more effective for female CTOs, and how district leadership perceptions and practices impact CTOs.

Dedication

I dedicate this work to my parents, Danny and Susie Adams, who supported and encouraged me in everything I have pursued and taught me to believe in myself and my abilities. Thank you to my mother for raising her five daughters to be strong and independent, telling us stories about being the first girl to take metal shop class, which led to her district changing its dress code to allow girls to wear pants, years before Title IX was passed and discriminatory dress codes were prohibited. Thank you to my father for instilling in me a strong work ethic and for teaching me as much about baking and sewing as he did about hunting and using power tools.

I also dedicate this work to my children, Jack and Piper, who endured my long hours of Zoom classes and late nights of work. You both were responsible for more than what was fair for kids your age, and I am so grateful for your love and support as I build a better life for us. I love you both so much and hope you are proud of your mommy.

Jack, my helpful, witty, wonderful son, may you grow into the type of man who loves and supports the women in your life in the same thoughtful, caring way you love your sister and me.

Piper, my strong-willed, free-spirited daughter, you have a beautiful light within you. As you grow, I pray you keep brightening the lives of others and never let anything or anyone dim your joy or your resolve.

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Chapter 1

Introduction

In 2019, women comprised 47% of the total U.S. workforce and nearly 75% of the education field (U.S. Bureau of Labor Statistics, 2019). If women are 75% of the education industry, it should follow that those women would have similar representation at every level of district leadership; however, this is not the case. During the 2022-2023 school year, a female held the superintendent position in 26.44% of school districts nationwide (Thomas et al., 2023).

The disproportionality in the number of women attaining top leadership positions in educational technology (EdTech) is similar to that of female principals in K-12 education. Similarly, women have held an average of 27% of chief technology officer (CTO) positions in K-12 schools since 2019 (CoSN, 2021b). Outside of education, women are outnumbered 3-to-1 by men in all computing-related occupations (Ashcraft et al., 2016). Women hold 11% of the technology industry chief information officer positions in the United States and only 7% globally (Ashcraft et al., 2016). Only 20 women, or 4%, hold chief executive officer (CEO) positions at all Standard and Poor's 500 companies, and "of these 20 women, 5 are in tech-related industries" (Ashcraft et al., 2016, p. 16). While women in K-12 educational technology leadership have higher representation overall than female leaders in the private technology industry, the gender gap is still wide.

Background

In 2013, CoSN began conducting annual surveys of K-12 EdTech leaders across the United States to give their members "a national perspective on the EdTech landscape,

the challenges EdTech Leaders face, and the successes they have had" (CoSN, 2023, p. 3). In 2016, the annual CoSN survey featured a specific question asking participants to specify their gender. Of the respondents on the 2016 survey, 36% identified themselves as female, which decreased to 33% in 2023 (CoSN, 2023, p. 8). Additionally, female CTOs still have lower salaries than their male counterparts. Only 37% of female CTOs earned a salary of $100,000 or more, compared to 49% of male CTOs in that salary range (CoSN, 2023). Where we should see progress due to more opportunity and equitable practices, the gender disparity in EdTech leadership has remained the same over the last decade. Table 1 shows the percentage of K-12 CTOs by gender from 2016 to 2023.

Table 1

Gender Percentage of K-12 CTOs

Gender	2016[a]	2017[a]	2018[a]	2019[a]	2020[a]	2021[b]	2022[b]	2023[c]
Male	64	64	70	72	75	72	64	65
Female	36	36	30	28	25	28	34	33

Note. Percentages based on responses from annual CoSN leadership surveys. [a]CoSN (2020, p. 8). [b]CoSN (2022, p. 8). [c]CoSN (2023, p. 8).

Of all female CTOs, 75% have a professional background in education, while only 22% have a background in technology, and the remaining 4% have a background in business, management, or another field (CoSN, 2023). Most male CTOs have a technical background (53%), followed by an education background (45%) or a background in business, management, or another field (3%) (CoSN, 2023). According to the 2023 CoSN

survey data, CTOs with a professional background in education are now the majority at 55%, an increase from only 45% of CTOs with an education background in 2013. Since more female CTOs have a background in education than men, the trend to hire a CTO with an education background over a technical background might benefit women.

Statement of the Problem

Women have been outnumbered 3-to-1 by men in K-12 CTO positions, even though women pursuing those positions usually have had more degrees and educational experience (CoSN, 2017). Furthermore, women who attain EdTech leadership positions earn less money and have less prestigious titles than their male counterparts (CoSN, 2017). For a decade, CoSN has conducted quantitative research to examine K-12 EdTech leadership and trends, such as spending and staffing. However, the researcher could not find qualitative research on female chief technology officers in K-12 education. Women working in the technology sector outside of education have been studied more extensively. However, because the findings often do not relate to educational organizations, the suggestions and solutions to the problem of gender disparity in the private sector are not always applicable. The limited research on K-12 EdTech leadership highlights the gender disparity, but it does not consider the experiences women in K-12 EdTech leadership had that supported or hindered their attainment of a CTO position.

Purpose of the Study

The purpose of this qualitative, phenomenological study was to explore the experiences of female K-12 EdTech leaders and discover who or what supported or hindered their pursuit or fulfillment of the responsibilities of a CTO position. Specific details about participants' internal and external supports like skills and personal or

professional experiences; education, training, certifications, and background; and mentoring or sponsorship from colleagues, will help the researcher understand their experiences. Likewise, details about hindrances, such as barriers to resources, inequitable policies or practices, and biases, stereotypes, or sexism, will help the researcher understand any negative experiences and how those impacted participants.

Significance of the Study

This study contributes to the scholarly research surrounding gender disparity in K-12 EdTech leadership. In the specific field of K-12 CTOs, CoSN has conducted annual surveys for a decade and asked respondents to identify their gender since 2016 (CoSN, 2023). This demographic and quantitative data, while helpful in illustrating the gender disparity, does not investigate why the gender gap is still so pervasive. By collecting qualitative data from female K-12 EdTech leaders, the study results could pinpoint examples of what supported or hindered women who have attained a CTO position. These findings could benefit current and aspiring female CTOs, their male counterparts who can be allies and sponsors for women in EdTech, and district leaders who can adopt more equitable recruitment and retention strategies for building more diverse technology teams within their school districts. The findings of this research could also impact women working in technology outside of education and the young women and girls in school districts who may or may not see themselves represented in their school district's EdTech leadership.

Delimitations

Lunenburg and Irby (2008) wrote that delimitations are "self-imposed boundaries set by the researcher on the purpose and scope of the study" (p. 134). This study was

conducted with voluntary participants who identified as female and who were currently working or recently retired as a CTO for a K-12 school district in the United States. This study only included data from full interviews via Zoom.

Assumptions

According to Lunenburg and Irby (2008), "Assumptions are postulates, premises, and propositions that are accepted as operational for purposes of the research" (p. 135). The researcher in this study assumed the participating CTOs responded to the interview questions honestly, fully, and accurately. Another assumption was that participants who did not fully answer questions would then elaborate and share more information in response to probing questions from the researcher.

Research Question

Research questions give the study direction and contain the essence of the study for those who review them (Lunenburg & Irby, 2008). This study was conducted with a semi-structured interview methodology. It was guided by the following research question: What experiences have women in K-12 EdTech leadership had that supported or hindered the pursuit or fulfilling the responsibilities of a CTO position?

Definition of Terms

According to Lunenburg and Irby (2008), any terms used in the study that are not commonly known should be defined, and the definitions should come from a "professional reference source" (p. 119). The following terms used in this study are defined because they may not be commonly known by all readers.

Chief Technology Officer (CTO)

The term CTO is used to describe the primary technology leader in a school district. CoSN (2021b) defines CTOs as "education technology leaders who are responsible for technology that is increasingly complex, greater in number and scope, and ever more integrated into the daily instructional and administrative routines of today's school districts" (p. 3). CTOs are known by many titles, including chief information officer, director of technology, and technology coordinator. Using the term CTO offers a single term for a school district's primary technology leader, regardless of what each district labels that position.

EdTech

A compound abbreviation for educational technology, the term EdTech describes a specific area of technology used for teaching and learning. CoSN (2013) stated, "In the classrooms of today, technology is an integral part of how students learn and are assessed, how teachers teach and are evaluated, how parents are kept informed, and how an individual school is integrated into district and state enterprises" (p. 1).

Mentor

The American Institute for Research (2015) describes the mentor relationship as "one in which one colleague supports the skill and knowledge development of another, providing guidance to that individual based on his or her own experiences and understanding of best practices" (p. 4). Arbisi (2021) defined a mentor as a "coach, guide, and support with vast experience in a field that improves the initial success and confidence of a mentee" (p. 5). The latter definition points out that mentors can function as professional and personal supports at times.

Sponsor

Unlike a mentor, a sponsor is a more senior person in the organization "who champions your career advancement, nominating you for stretch assignments or promotions and talking you up in the discussions you're not a part of" (Anderson et al., 2013, p. 11). A sponsoring relationship is mutually beneficial, while a mentoring relationship primarily benefits the mentee. Anderson et al. (2013) describe how the sponsored junior strives to succeed for their sponsor and is "equally committed to supporting their sponsor as the senior person is when it comes to being invested in the success of their protégé" (p. 11).

Organization of the Study

This study's background information, statement of the problem, the purpose of the study, significance, assumptions, delimitations, assumptions, the research question, and definition of terms were presented in this chapter. Chapter 2 reviews the literature on gender disparity in technology and other male-dominated fields. Chapter 3 presents the research methodology used in this study, which includes the research design, setting, sampling procedures, instruments, data collection procedure, data analysis and synthesis, reliability and trustworthiness, researcher's role, and limitations. Presented in Chapter 4 are the results and summation of the themes that emerged from the interviews. Chapter 5 contains the study summary, findings related to the literature, and conclusions.

Chapter 2

Review of the Literature

The existing literature regarding women in educational technology leadership is reviewed in this chapter. A discussion of gender inequality in science, technology, engineering, and math (STEM) and leadership provides data on the underrepresentation of women in technology leadership, educational leadership, and EdTech leadership. This chapter includes research on the external and internal supports for women in male-dominated fields like technology. Research on the external and internal hindrances of women in male-dominated fields like technology is also provided in this chapter.

Gender Inequality in STEM and Leadership

In 1994, Hon. Marilyn Lloyd testified before the U.S. House Committee on Science, Space, and Technology, 103rd Cong. (1994) and shared the findings from government research in a series on women in science and technology, seeking to investigate gender bias in precollege science and mathematics education. The committee found biases in how girls and boys engaged with and were treated in science and math courses as early as kindergarten. The committee found that teachers in math and science classes called on boys twice as often as girls. Furthermore, teachers tended to ask boys to explain how they got a correct answer or challenged them to find the correct answer when they were wrong. However, those same teachers praised girls for their correct answers or corrected them when they gave the wrong answer. In hands-on math and science work, the committee found that boys tended to run the equipment while girls were left to record data or write results. The committee stated that 51% of boys had used a microscope by third grade, while only 37% of girls in the same courses had used a

microscope. The committee found that by seventh grade, boys and girls had equal performance in math and science classes; however, girls consistently underestimated their abilities and exhibited low confidence before completing tasks, even when their achievement on the task was as high as their male classmates. The committee also found that in elementary school, 31% of girls believed they were good at math, but by middle school, only 18% felt that way. The U.S. House Committee on Science, Space, and Technology, 103rd Cong. (1994) found that girls and boys had equal enrollment in math courses until calculus, when 7.6% of boys took calculus compared to only 4.7% of girls. The committee compared girls and boys who took physics and calculus in high school and found that 19% of those girls intended to major in science or engineering in college, while 64% of boys planned to major in those subjects. Regarding general educational equity for girls and women, the committee also highlighted research on the gender disparity in school and district leadership, citing that females held 27.7% of school principal positions and only 4.8% of superintendent positions in the United States.

Regarding the importance of representation for decreasing the gender gap, the U.S. House Committee on Science, Space, and Technology, 103rd Cong. (1994) found that, while public high school teachers across 40 states were split evenly at 50% male and 50% female, there were fewer female teachers in the areas of math (45%), biology (37%), chemistry (35%), and physics (22%). The committee also cited interventions that had reduced the gender gap in K-12 math and science courses. The committee found that small group instruction and content-based activities focused on spatial relationships led to increased achievement for girls in science and math courses. The committee also found that when male science teachers participated in equity education training, their female

students exhibited improved motivation and attitudes. The committee indicated that this improvement was even more evident in rural school districts compared to urban or suburban districts and saw a correlation between teacher equity education training and improvement among their female students, regardless of the teacher's gender.

Stuart (2008) studied women in business leadership and found that many believed books, texts, and other curricula during their school years did not portray women as leaders. Stuart (2008) pointed out, "Although some textbooks have become more gender-conscious, many still portray females in stereotypical roles that reinforce bias. To overcome this problem, educators need to re-examine curricula and textbooks and focus on the responsibility of teachers as role models" (p. 65). Over 50% of Stuart's respondents also acknowledged the thoroughly researched decline in girls' self-esteem during middle school. Respondents recalled a distinct decline in their self-esteem during this age that was "primarily attributed to being immersed in a male-dominated environment" (Stuart, 2008, p. 66). Some respondents even commented on harassment they endured from boys and adults conditioned them to accept the behavior as "boys will be boys" (Stuart, 2008, p. 67). These seemingly double standards only exacerbate the lack of confidence of girls and young women.

In grades 2 through 11, there were no gender differences on standardized math tests, but boys begin to outperform girls in high school at complex problem-solving, a skill that is important for success in engineering and mathematics fields (Logel et al., 2009). This timing coincides with socializing and dating between males and females: "As some adolescent boys begin to view girls primarily as sex objects, and girls come to see

themselves as women for whom stereotypes about women's math ability apply," sexist behavior triggers social identity threat in teenage girls (Logel et al., 2009, p. 1101).

Jung et al. (2017) investigated the influences behind whether women and men decide to pursue a major in technology. Participants were undergraduate students registered in computer science, computer information technology, and management information systems courses at a North Carolina university. Participants were surveyed with questions Jung et al. designed from their analysis of the existing research identifying the major influences impacting the decision of women to enter the technology field. Questions focused on the influence of marketing, media portrayal of women in technology, role models, social encouragement, and the impact of education. Jung et al. found that males reported higher confidence and more experience in programming than female respondents. Researchers also found that more exposure to computer science and other technology courses in K-12 education did not significantly impact whether women were more likely to major in technology in college. However, having exposure to role models was reported as a positive influence for young women to pursue a technology major. However, Jung et al. did not specify if a role model of the same gender impacted women. Most respondents also reported "you have to be smart to major in technology" and that those who do are intelligent and "nerdy," which could deter certain women from pursuing a technology major (Jung et al., 2017, p. 32).

Women in Technology Leadership

Thomas (2005) completed qualitative research interviewing 25 female information technology (IT) executives working at Fortune 500 companies. Participants were asked about demographic data, educational background, work history, factors that

assisted and hindered their career development, and future career goals and perceived barriers to those goals. Demographically, most women in the study were an average of 48.3 years old, married, White, had children, and did not plan to have additional children. All participants had bachelor's degrees in computer science, engineering, mathematics, or business. Most participants with a bachelor's degree also had a master's degree. A master's in business administration was the most common master's degree earned by participants. Only 44% of the participants reported becoming interested in IT during school; however, they cited exposure to computer science and teachers' encouragement to succeed in math and technology as factors that encouraged them to pursue the IT field. Participants reported high levels of job satisfaction but reported being underrepresented as a woman or even as a woman of color in a mostly White male field added difficulties and was isolating at times.

Thomas (2005) found most women in the study reported satisfaction with the speed at which their careers had progressed but indicated the following factors for their career not progressing as quickly as it could have: male-dominant company or job area (71%), being a woman (57%), and their company did not encourage, support, or develop women for top-level positions (43%). Participants reported liking their jobs due to a high level of responsibility (52%), continuously being challenged (48%), and making valuable contributions to their business and society (48%). Participants reported disliking their jobs due to internal policies (30%) and too heavy of a workload (25%). Participants reported that collaborative and teamwork-oriented environments were the two most common workplace factors that had helped them succeed. Participants reported feeling hindered by male-dominated or good old boy culture (86%), decentralized workplaces

(42%), highly competitive workplaces (42%), and having an overly polite culture in the workplace (29%). Participants reported personal and family life aspects often hindered their careers, specifically citing the following: difficulty balancing work and family (75%), having children slowed career progression (25%), and difficulties in their marriage (25%). Additionally, 52% of participants reported sacrificing time with their children or spouses to succeed in their careers. Participants perceived several work activities or events assisted them in their career development, including continuous learning, training, and development (60%); directing a major project (48%); and promotion to a higher-level position (44%). While all participants reported that role models had positively influenced their careers, forming networks and coaching from mentors were both cited by only 16% of participants as impacting their careers.

Thomas (2005) asked participants what hindrances they experienced that they did not think a man would have experienced. Respondents did not perceive men had struggled with work-life balance (40%), been overlooked for opportunities or promotions (36%), to prove themselves (28%), and put their careers on hold to have children (28%). Further, participants perceived companies provide fewer opportunities for advancement to women due to being unwilling to accommodate women's family responsibilities (47%), women with children having difficulty with work hours (42%), holding women to higher standards for advancement (32%), and women having to prove themselves repeatedly (26%). Further, 56% of participants aspired to a higher-level position in the future, and 60% reported that women being underrepresented as IT executives has spurred their future career aspirations. In general terms of underrepresentation, 100% of participants reported being adversely affected by a lack of female role models and

mentors, and 66% stated that women's job performance is looked at more critically than their male counterparts.

Despite career ambition and leadership aspirations, women are still not achieving senior leadership positions at the same rate as their male counterparts. Anderson et al. (2013) reported that women have strong leadership ambitions with over 85% of women working in technology wanting career advancement in the next three years and 62% desiring a C-suite or senior management position. Likewise, Hewlett et al. (2014) found that 76% of women working in technology, engineering, and science careers reported being "very ambitious, and 70 percent are eager to be promoted to the next job level" (p. 2), so it cannot be argued that there are so few women in technology leadership positions because women do not desire senior leadership.

Some researchers suggest that technology companies led by women are more successful than those without female leaders. Post et al. (2021) examined how technology companies shifted their strategy and innovation after appointing female leaders. Based on an analysis of more than 150 companies, the authors found that after women join the top management team, firms become more open to change and less open to risk. The authors pointed out that when women join senior leadership, they shift how the organization thinks about innovation. Furthermore, Post et al. found that impact was highest when two or more women were on the leadership team, which could suggest that having a single or "token" female in leadership is not as effective as having multiple women on a leadership team or could also suggest impact increases with the number of women in leadership.

Noland et al. (2022) gathered data from nearly 22,000 companies in 91 different countries. Their analysis provided evidence that a move from no female leadership in the

C-suite or higher to 30% female representation was associated with a 15% increase in net revenue. The researchers found an increase in female leadership and profit. Noland et al. (2022) elaborated that the findings could be attributed to either non-discriminating firms having an edge over those who discriminate against female executives, or the presence of women contributing to "superior performance via functional diversity" (p. 16). The researchers also found no increased revenue or other benefits to companies with a gender representation quota for their board of directors.

Regardless of the company's profit margin, women working in technology seem to earn higher salaries when their company has a higher percentage of female executives. Frey (2020) examined the gender makeup of executive teams at 31 of the largest technology companies in the United States. Companies where women made up more than 25% of the executive team were considered to have a high rate of female executives, while companies with fewer than 20% were considered to have a low rate. Frey then analyzed 6,562 salary profiles of people who reported working for these companies between June 2015 and 2017. The researcher examined the gender pay gap in two ways. First, salaries between men and women at similar levels and with similar years of experience were compared. Then, the median salaries for men and women, regardless of job level or experience, were examined. At companies with more women executives, women earned 98 cents for every dollar that men in similar roles earned, a disparity that could add up to tens of thousands of dollars over a woman's career. When you compare men and women without controlling for whether they are in similar roles and levels, the researcher found women make 86% of men's salaries. Frey suggested these findings highlight an opportunity gap: companies with a high percentage of women execs also

have more women in other highly-paid roles. The researcher also noted that men and women both report higher levels of job satisfaction and a low desire to leave their company in the next six months when they work for a company with more women in leadership. Frey did not suggest a cause for the increased job satisfaction but discussed how companies with intentional practices to diversify staff are often involved in other hiring and retention practices that could result in higher job satisfaction and employee morale.

Women in Education Leadership

In the education field, there is a plethora of research on the gender disparity of school district leadership, especially a lack of female superintendents. Thomas et al. (2023) reported survey data from The School Superintendents Association (formerly known as the American Association of School Administrators [AASA]). During the 2022-2023 school year, a female held the superintendent position in 26.44% of school districts across the nation. Thomas et al. noted that 72.86% of respondents were male, slightly lower than in 2020 when males comprised 74% of all superintendents nationwide. When comparing the gender of superintendents to race, no significant differences emerge except when comparing Black female superintendents (6.67%) to Black male superintendents (2.86%). Thomas et al. noted no significant differences when comparing the gender of superintendents to school district size. The same was true when comparing gender in rural, suburban, and urban district classifications. When examining years of experience and gender, Thomas et al. found a larger percentage of females (58.45%) had fewer than six years of experience in their current positions compared to males (43.65%), and nearly twice as many males (23.71%) had been a superintendent for

11-20 years compared to females (13.65%). Thomas et al. also found that female superintendents have higher levels of education than males in the same position. When comparing degrees held by superintendents, 39.69% of female superintendents had an EdD compared to 32.75% of males, and 10.85% of women had a PhD compared to 5.76% of men. When comparing salary to gender, Thomas et al. found that male superintendents' median salary was lower than females. This finding is unique, noted Thomas et al., since female superintendents tended to work in smaller districts and had fewer years of experience.

Women in EdTech Leadership

Clark (2013) conducted research in cooperation with EDUCAUSE Center for Analysis and Research. The researcher surveyed 188 male and female members from the EDUCAUSE database who were chief information officers (CIOs) at higher education institutions. Nine of the female CIO respondents agreed to participate in the second part of the study that was structured to assess the organizational and personal factors that contributed to their attainment of a CIO position. Clark found that most female CIOs in higher education have a background in business (26%) or technology or computer science (22%), while fewer had a background in education or administration (13% and 4%, respectively). The researchers found female CIOs in higher education spent significantly more hours in the office and less likely to use flexible work options like a compressed work week or remote options. Female respondents were asked why and many perceived they needed to be visible to coworkers to be seen as "worthy leaders" or "to prove themselves" (Clark, 2013, p. 10).

Respondents in Clark's (2013) study also stated a need to be more self-aware of their leadership behaviors and even adopt more masculine behaviors like being more aggressive. Four of the nine respondents reported experiencing bias in hiring or promotion processes, while four reported experiencing no biases during hiring or promotion, and one respondent remained neutral. When it came to salary, 70% of female higher education CIOs earned less than $150,000 annually, compared to 57% of male counterparts earning under that amount. The researcher's findings also reflect the body of research showing women's discomfort with salary negotiations, which could contribute to lower salaries for female CIOs. Female CIOs in higher education reported spending an average of 5.6 hours per week more on home-related duties than male respondents. When asked about role models, male and female respondents agreed that role models are important, and women responded that seeing women in leadership is a comfort to other women. However, respondents felt neutral about how role models had impacted their own decisions to become a CIO, and the researcher found no significant differences between male and female respondents when asked about role models. Clark found no significant differences on mentoring and gender but noted that male and female respondents perceived mentoring as important. Clark noted one female participant's praise of a women's leadership network and pointed out the need for more research on the effectiveness of different mentoring models used with CIOs in higher education.

Wiggins (2021) conducted qualitative research examining the experiences that led to the leadership attainment of female CTOs in community colleges. The researcher investigated lessons learned by these CTOs and the factors supporting persistence through the many known barriers women face in technology leadership. Wiggins noted

the importance of how all participants had a positive growth mindset and viewed barriers as a temporary obstacle they could overcome. Participants also reported a high level of passion for their work and dedication to advancing the field to be more equitable for women in the future. Other themes that emerged in this research were female CTOs feeling called to their positions from various work and educational backgrounds, believing general leadership development is paramount to success as a CTO, responding to barriers and other obstinate practices with determination and tenacity, and encouraging other females to further advance the field.

CoSN collects survey data annually from K-12 CTOs in the United States. CoSN (2023) presented their findings within the context of 10 years of data collection, framing their most recent data in comparison to 2013, the inaugural year of CoSN's annual survey. In 2016, the first year CoSN began asking participants to report their gender, 36% of CTOs were female. The percentage of female CTOs in 2023 had decreased to 33%. While CoSN found that salaries of CTOs had increased overall from 2013 to 2023, women still earned less than men. CoSN found that 49% of male CTOs earned salaries of $100,000 or more compared to 37% of women. While CoSN asks participants their ages and years until retirement, participants were not asked their years of service in the most recent survey. That additional data point could further describe the gender pay gap among CTOs.

CoSN (2023) reported that in 2015, 88% of CTOs reported their race as White, Caucasian, or European, which slightly decreased to 86% in 2023. While CoSN does not disaggregate data on race and gender, 2023 data show CTOs are still primarily White and male, making women of color the most underrepresented among all CTOs. CTOs with a

background in education increased in 2023 to 55%, followed by a background in technology at 42%. This trend suggests those in charge of hiring CTO positions in 2023 were less likely than they were in 2013 to see a technical background as a requirement for fulfilling the responsibilities of a CTO. This trend could benefit women pursuing a CTO position, as CoSN found a 75% majority of female CTOs with a background in education, compared to only 45% of male CTOs in 2023.

External Supports

Though the number of women in technology, leadership, and other male-dominated fields is low, we can learn from the women who have attained leadership positions. This section explores research on women in EdTech leadership and what researchers and participants have identified as external supports. The external supports of female leadership initiatives, mentoring, and professional development are discussed.

Female Leadership Initiatives

Mann (2021) conducted a study with the primary objective of evaluating the effectiveness of women leadership programs (WLPs) in facilitating the advancement of women to senior leadership positions within the technology industry. The study's findings shed light on the significant positive impact of WLPs on women's career progression. Notably, the research findings revealed that women, even those at more advanced stages of their careers, derived substantial benefits from participating in these programs, particularly through networking opportunities and mentorship. These results underscore the valuable role that WLPs can play in fostering gender diversity and leadership development within male-dominated fields such as the technology industry.

Even women in the later years of their careers reported a benefit from networking and mentoring as part of the WLP.

Awodogan (2023) collected data on successful strategies used by three technology leaders in the United States to increase female leadership in their organizations. Awodogan investigated strategies that leaders of technology organizations use to create a positive culture and climate within their organizations and adequate support that allows women to occupy leadership positions. The researcher identified developing female skill sets, promoting development programs and continuous training, work-life balance amongst female employees, and networking programs to support female employees with leadership aspirations. Awodogan also noted the importance of networking and connecting with professional organizations to encourage mentorship and sponsorship both within and outside their organization.

Mentoring

Mentoring has been recognized as a valuable strategy for supporting career development and fostering professional growth, particularly for underrepresented groups such as women. According to Kram (1988), the mentoring relationship has two functions. The first is career function, and the second is psychosocial function. Kram found that male mentors generally offer career functions, including protection, exposure, coaching, and feedback. Female mentors are more likely to offer psychosocial functions, encompassing acceptance, friendship, and counseling.

However, it is important to note that solely relying on same-gender mentoring has limitations, especially for women working in male-dominated fields. Noe (1988) found that mentors matched with opposite-sex proteges reported that these proteges used the

mentorship more effectively than did proteges with same-sex mentors. Noe collected his data in an educational setting where women had more stereotypical subordinate roles than male supervisors. Noe hypothesized that proteges in opposite-sex mentoring relationships worked harder to make the relationship successful because of the possible difficulties of cross-gender relationships at work. Noe also found that mentors believed that women more effectively utilized mentorship than men because woman recognized the importance of such relationships to their career advancement.

Dreher and Cox (1996) studied how race, gender, and mentoring experiences impact college graduates of a business program. The researchers found that graduates of color were less likely than White graduates to build mentoring relationships with White men. Women of all races were less likely than men to form such relationships. Graduates mentored by White men earned an average of $16,840 more annually than those mentored by men of color or women. Researchers found that those mentored by women or men of color earned the same salary on average as those who never established a mentoring relationship.

Burke and McKeen (1996) studied the impact of male and female mentors on female mentees early in their careers in a male-dominated organization. The researchers found the only statistically significant differences were that women with female mentors received more psychosocial functions in their mentoring relationship “and reported greater intention to quit” (Burke & McKeen, 1996, p. 97). The researchers also found that women with female mentors tended to earn lower salaries and attain lower-level positions within the organization than women with male mentors.

Ragins and Cotton (1999) found that mentors are critical to the career success of women. The researchers found that informal mentoring positively impacted mentees more than formal mentoring. This finding can be explained by stronger relationships being developed when they grow naturally or informally between a mentor and mentee compared to when a relationship is assigned through formal mentoring, which does not account for personality traits that impact a mentor and mentee. Ragins and Cotton focused on gender and mentoring functions and outcomes. The researchers found that females mentored by men earned significantly higher incomes than females with female mentors. The researchers noted that while females with male mentors earned more promotions and higher salaries than those with female mentors, the women still earned less than males with a mentor of either gender. Ragins and Cotton found that females with female mentors reported lower job satisfaction and were likelier to report intentions to leave their position in the future. The researchers also noted that when comparing formal and informal mentoring, female mentees report the fewest benefits from formal mentoring.

Women of color may benefit from having a racially matched mentor. Blake-Beard et al. (2011) studied students in a post-secondary STEM program who had mentors who were matched by race and gender compared to those who were not. Many participants, especially the female participants, reported that having a mentor of the same gender or race was somewhat important for success. In terms of mentoring relationships, students reported receiving more help when they had a mentor of their own gender or race. Matching by gender or race made no difference in academic achievement or improvement. There were no differences in students' self-reported GPAs, efficacy, or

confidence in their STEM ability based on being matched by gender or race, even for those who indicated that a matched mentor was particularly important to them.

A common approach to mentoring as part of gender equity initiatives in male-dominated fields is same-gender mentoring, a structure in which women mentor other women. Dennehy and Dasgupta (2017) investigated the effect of peer mentoring on retention during women's first year of college in a STEM program. The researchers sited a foundation of research that signals to women in STEM that they are outsiders and points to possible causes for the gender gap in STEM areas, which include unfriendly or hostile environments toward women, use of masculine pronouns to refer to scientists or engineers, and the prevalence of sexist jokes. The researchers found that female mentors protected women's belonging in STEM, self-efficacy, motivation, retention in STEM majors, and career aspirations, while male mentors did not. The researcher found significant increases in retention and career aspirations when women experienced higher levels of self-efficacy and belonging. The researchers noted that the benefits of this mentoring endured long after the intervention ended, inoculating women for the first two years of college when the highest attrition rate for women with STEM majors occurs. Dennehy and Dasgupta posited that same-gender mentoring promotes women's success and retention in STEM and can have lasting effects on their careers.

Arbisi (2021) investigated the effect mentoring had on technology use by K-12 educators. Arbisi described mentoring in education as a significant tool to develop new teachers that impacts retention, effectiveness, and student achievement. The researcher found several areas that impact the success of mentoring. First, Arbisi noted the importance of a personal relationship between mentee and mentor, emphasizing this area

as a requirement for transferring technical knowledge, resources, and skills. During the study, Arbisi encountered mentor and mentee pairs who were not closely matched based on the subject area and grade level they taught. The researcher suggests a team approach in these situations, resulting in the mentee having multiple mentors providing some of the supports, compared to a single mentor who may struggle to provide all the necessary supports for a mentee in a dissimilar teaching position. The findings could have significant implications for mentoring in any technology field. Arbisi found that technical knowledge transfer was higher when mentoring pairs were matched by content area but noted that this is not always possible. In those situations, Arbisi recommended a team mentoring approach where a mentee could have one mentor who matched one need (like subject area) and a second mentor who matched another need (like grade level). Arbisi's suggestions for increasing technical knowledge transfer for teachers through team mentoring could hold even greater significance for minority groups in technology, like people of color and women. These two groups could benefit from team mentoring to address their unique need for a mentor who can support them professionally and personally.

Professional Development

Simard et al. (2008) described professional development as the most profitable step high-tech companies can take to advance technical women and retain talent. The researchers surveyed "1,795 technical men and women at seven high-technology companies in the Silicon Valley region" (Simard et al., 2008, p. 11) and found that participants valued opportunities to update their technical skills through professional development. "In addition, technical development programs will provide networking

benefits to further propel technical women's advancement" (Simard et al., 2008, p. 5). The researchers also found that over half of the technical workforce, both men and women, hold advanced degrees. However, "While men and women are equally likely to hold advanced degrees, technical women in our sample are less likely to have earned degrees in computer science and are more likely to have earned degrees in non-technical fields" (Simard et al., 2008, pp. 16-17).

Internal Supports

While organizations and corporations can provide external supports for women, internal supports are also important. In this section, the research related to women in EdTech leadership and what researchers and participants have identified as internal supports are explored. The internal supports of self-efficacy, having a positive impact, and stereotype reactance are discussed.

Self-Efficacy

Petersen (2014) studied female college juniors and seniors pursuing a biology, math, or physics degree. The researcher investigated their perceptions of how their K-12 education impacted their pursuit of a STEM degree. Petersen defined self-efficacy as a person's beliefs about her abilities and found it was greatly impacted by K-12 teachers who praised their achievement in STEM courses and encouraged them in those areas. Petersen found that females pursuing STEM degrees in college are motivated by having female teachers in STEM courses and seeing themselves represented by instructors, as well as hearing those female role models share stories demonstrating their own self-efficacy in the face of adversity.

Mootry (2018) interviewed 10 women in senior-level technology positions to discover how the supports they received helped them overcome internal barriers to achieving leadership positions. Mootry found that all participants described actions and behaviors indicative of high self-efficacy. Participants reported networking, self-promotion, communication, relationship building and other professional development strategies to improve their professional value. Mootry highlighted the importance of self-promotion and the reluctance women often have to self-promote as a hindrance to their professional advancement. Mootry found that all participants shared their use of self-promotion in ways that demonstrated self-efficacy.

Having a Positive Impact

Petersen (2014) also found that all participants were passionate about impacting the world and studying STEM because of its positive impact on others. Petersen stated that women tend to choose people-oriented careers that contribute to society. The study participants confirmed a desire to have jobs within STEM fields where they can interact with people, make a difference in the world, and help others. Petersen noted that STEM careers can be isolating and abstract, so it is important for women pursuing and working in STEM careers to see the positive impact of their work.

Sax et al. (2017) analyzed national survey data on eight million college students spanning four decades from 1971 to 2011. Sax et al. sought to identify key factors in the gender gap among computer science majors. The researchers compared the characteristics of women and men who chose a computer science major and documented how trends in choosing a computer science major have changed over time among undergraduate women and men. One of the key factors to the gender gap in computer

science that the researchers identified was a female's desire for doing social good, an outcome not often associated with computer science.

Lewis et al. (2019) surveyed 5,821 students pursuing a computing-related undergraduate degree in over 100 colleges and universities in the United States. The researchers asked participants to rate how important it was for their future careers to allow them communal goals, which the researchers describe as giving back to their community, having a social impact, serving humanity, and helping others. Lewis et al. found that women and underrepresented groups express a greater desire to do social good. Coupled with their findings that computer-related fields are not always perceived as having high communal goals, the researchers posited that fewer women pursue computer science fields because they do not recognize that to enact their communal goals. Lewis et al. also found that perceptions of communal goals in computer science led to a greater sense of belonging in computing. Participants who perceived computing as meeting more communal goals tended to have a higher sense of belonging in computing compared to their peers who perceived computing as meeting fewer communal goals.

Stereotype Reactance

Stereotype threat, discussed later in this chapter as an internal hindrance, can sometimes positively affect women. Kray et al. (2004) found that when faced with a stereotype threat, women responded by behaving in opposition to the stereotype, called stereotype reactance. Kray et al. studied 94 male and female business students at a large, southwestern university. Female participants were told they were not expected to negotiate higher salaries because successful salary negotiations were due to stereotypically masculine qualities. The female participants reacted by associating

themselves with those qualities and distancing themselves from more stereotypically feminine qualities, and in turn, negotiated higher salaries than the control group. These findings suggest that when faced with an explicit stereotype, a person can overcome a stereotype threat through reactance.

Petersen (2014) also found that all participants thrived on challenges. Participants reported seeing struggles or difficulties as a motivation to work harder to overcome the challenge, and several described themselves as competitive and even defiant. Petersen elaborated that participants shared specific examples of how female teachers' stories of their struggles and accomplishments were impactful. While Petersen did not explicitly discuss stereotype reactance, the participants' responses described the phenomenon.

External Hindrances

Because there are few women in technology, leadership, and other fields related to EdTech despite their interest and skill in those fields, it is obvious that there are factors hindering women from attaining such positions. Explored in this section is research related to women in EdTech leadership and what researchers and participants have identified as external hindrances. The external hindrances of lack of support; barriers to resources; bias, sexism, and stereotypes; and organizational structures are discussed.

Lack of Support

Women may have leadership goals, but many report a lack of support for their career aspirations. Anderson et al. (2013) investigated the perceptions of women working in the technology sector regarding the support they received for their career advancement aspirations. The findings revealed a striking disparity, as approximately one out of every four women surveyed perceived their respective organizations provided adequate support

for their professional growth and advancement within the field. This statistic sheds light on a concerning trend within the technology industry, where a significant portion of female professionals reported being hindered in their pursuit of leadership positions.

Equally problematic for women striving for leadership in the technology field are the research findings from Ashcraft et al. (2016), who investigated the perception of gender representation in technology leadership. Focusing on male CEOs, the researchers revealed that approximately one-third of male CEOs reported that they did not perceive women as underrepresented in the technology field. This finding is significant as it highlights a disconnect between the perceptions of male leaders in the technology industry and the well-documented gender disparities within it. Also, the finding underscores the importance of examining the perspectives of individuals in positions of power and influence in male-dominated fields, as these perceptions can have far-reaching implications for the experiences of women striving to advance in these domains.

Barriers to Resources

While mentoring, specifically cross-gender mentoring, is beneficial for women in all fields, there are often barriers to accessing mentors for underrepresented groups like women in technology. Clawson and Kram (1984) explored the intricate dynamics of cross-gender mentoring, shedding light on the developmental dilemmas that often arise within such interactions. Their findings underscore the complexity inherent in cross-gender professional relationships, particularly within male-dominated fields. A notable challenge was managing both closeness and distance within the mentoring relationship. The researchers noted that the development of close professional relationships results in admiration, liking, and concern for a colleague; too much intimacy can arise when those

feelings are not channeled in a purely professional way. The researchers also noted that outside perceptions of a cross-gender mentoring relationship can vary, even when the partnership is kept strictly professional. The researchers suggested how to avoid negative perceptions and the pitfalls of impropriety by using strategies like not meeting alone, behind closed doors, after hours, or for long periods, and by establishing boundaries and only discussing areas of life where there can be a professional impact.

Another limitation to same-gender mentoring is evident in research by Carbado and Gulati (2004), who found that people capable of advancing in fields where they are part of an underrepresented group are unlikely to advocate for others in their minority group. The researchers studied racial minorities in corporate leadership positions to identify racial types who can achieve elite positions. Carbado and Gulati assumed that racial minorities in leadership would actively perform anti-discriminatory work for their organization. However, the researchers found that racial minorities in leadership did not reform their corporation, nor did they promote lower-ranking minorities from within their organization. The researchers identified strong incentives for minorities to assimilate into the status quo once they attained a leadership position. Furthermore, Carbado and Gulati (2004) noted that in most organizations, only those considered “racially palatable” (p. 1658) are promoted to leadership positions, perpetuating corporate racism and disguising it as diversification.

Kaiser and Spalding (2015) used the research by Carbado and Gulati (2004) as the basis of their research. Kaiser and Spalding found that women who climb the corporate ladder to attain leadership in male-dominated fields will sometimes climb and lift other women up the corporate ladder; however, some will climb and kick, working in

opposition to females in their organization. The researchers used two studies focused on women in male-dominated fields to test the hypothesis that some women show an expected pattern of promoting women while others favor men over women. In both studies, women's gender identification moderated how much they favored men over women when they advanced in a male-dominated field. Specifically, the weaker women's gender identification, the more favoritism they showed for a male subordinate compared to a female. The researchers found gender bias when females were underrepresented but not when the females were the majority or in an equally diverse field. Their findings contradicted initiatives like same-gender mentoring or female-led women's leadership programs intended to promote underrepresented groups.

Mangan (2018) reported on male mentors for females working in male-dominated fields and how the #MeToo movement has made men more reluctant to mentor females. Mangan noted the negative impact this could have on young women who struggle to find mentors in male-dominated fields. Mangan noted that the number of men reported being uncomfortable mentoring a female tripled in the year following the start of the #MeToo movement. Mangan noted that mentoring cannot simply fall to senior women because there are usually few and sometimes none. Mangan described the success of some organizations that require senior men to mentor inexperienced females; however, their success stems from the training and support given to the male mentors to counteract the reluctance, discomfort, and inexperience they may feel mentoring women.

Hill and Laguado (2019) conducted research on female graduate students in pharmacy schools in the United States. Their results provided more guidance for males mentoring females. Hill and Laguado reported that 60% of men are uncomfortable

mentoring, working alone, or socializing with a female colleague. Two themes emerged in their research regarding how male mentors can successfully work with female mentees following the #MeToo movement. First, male mentors should establish a safe environment. One example Hill and Laguado provided was to allow the female mentee to select the location and time of meetings. Another way to establish a safe environment is to create a space where the female mentee feels comfortable sharing her honest views. Male mentors can do this by showing they value their mentees' input and empowering their mentees to advocate for themselves. The second theme Hill and Laguado found was to think before speaking or touching. They pointed out the importance of using positive and supportive language with female mentees, as well as using respectful language when their mentee is not in the room and not tolerating disrespectful comments from any other colleagues. Physical contact with mentees was advised against altogether. Hill and Laguado noted some instances where it could be acceptable, like giving a pat on the back.

Bias, Sexism, and Stereotypes

Reicher et al. (2019) reported trends they found through their global research collaborations focused on psychological factors impacting leadership effectiveness. Regarding gender and leadership, Reicher et al. found that women faced challenges in advancing to leadership positions due to stereotypes and biases. The researchers reported that women's abilities were often underestimated, and they were seen as unsuitable for leadership positions for which they were as equally qualified as male colleagues. Reicher et al. reported that female leaders also encounter harassment and discrimination from various sources, which can affect their well-being, productivity, and career prospects. Women leaders are more likely to face backlash for raising ethical concerns or objections

to immoral practices or actions in their organizations. Reicher et al. discussed how this bias and unequal treatment undermines women's confidence and performance, often discouraging women from pursuing leadership opportunities.

Zenger and Folkman (2020) analyzed data from assessments they conducted in 2019 on male and female corporate leaders from over 100 companies nationwide. The researchers found that women were rated by those who work with them as more effective. Zenger and Folkman found that the gap between men and women during the pandemic was larger than in their previous study and stated this could indicate women are even more effective leaders during a crisis. Females were rated more positively on 13 of the 19 competencies Zenger and Folkman use in their 360-degree assessment that measures overall leadership effectiveness. The researchers also found that female corporate leaders experience double standards and conflicting expectations. Female participants reported struggling to balance friendliness with assertiveness, humility with confidence in skills, and collaboration with self-reliance. Participants also perceived experiencing stereotypes, biases, and unequal treatment more often than their male counterparts.

Organizational Structures

McDonald et al. (2004) researched 63 undergraduate White women from a large midwestern university, focusing on the influence of social status on their experiences leading male subordinates. The researchers indicated that being a "token" woman in such a setting had fewer negative implications when the woman held a higher status. In this context, status encompassed various factors such as age and experience. Women with higher status attributes reported having more positive experiences when leading groups of

men. The researchers suggested that increased social status could act as a protective factor, mitigating the development of negative expectations about interactions within male-dominated work groups. McDonald et al. (2004) noted that the concept of status was multifaceted, including characteristics like being "White, male, older, and in managerial positions as high-status attributes, while being a racial minority, female, younger, and in nonmanagerial roles" were considered low-status characteristics (p. 7). Even when these status characteristics were not explicitly emphasized, they significantly influenced social processes, impacting outcomes in group interactions and greater implications for women in leadership roles within male-dominated workplaces.

Burrell (2017) interviewed 13 higher education CIOs serving at colleges and universities of various sizes in the United States. Burrell found that a major barrier in hiring women for CIO positions was that institutional management teams responsible for hiring thought CIOs should have a technology degree. Burrell discussed the importance of recruiting women with other valuable skills and backgrounds and then providing them with any necessary deeper technical training to fulfill a CIO position.

Internal Hindrances

Obstacles might stand in the way of women who want to achieve EdTech leadership and other similar positions, and sometimes, women can be the obstacles standing in their own way. This section explores research related to women in EdTech leadership and what researchers and participants have identified as internal hindrances. The internal hindrances of social identity and stereotype threat and balancing work with life, family, and motherhood are discussed.

Social Identity and Stereotype Threat

Clance and Imes (1978) studied high-achieving women and found discrepancies in their self-image and level of success. The researchers interviewed over 150 high-achieving women and found that these women had a high tendency to doubt their intelligence or ability despite outstanding academic and professional accomplishments. The researchers coined the term imposter phenomenon to describe the "internal experience of intellectual phoniness which appears to be particularly prevalent and intense among a select sample of high achieving women" (Clance & Imes, 1978, p. 224). The researchers found imposter phenomenon can result in difficulty accepting praise or recognition for accomplishments, fixation on flaws or deficits and negative feedback, fear of failure or foolishness, and a tendency to overestimate others' intellect and competence while comparing themselves to others.

Peteet et al. (2015) conducted a study where they investigated predictors of imposter phenomenon in 161 academically talented Black and Hispanic students at a large, predominantly White college in the Midwest. Participants were surveyed using a tool that assessed racial and ethnic identity and feelings of affirmation, belonging, and commitment to that identity, as well as psychological well-being and imposter syndrome. The researchers found that low psychological well-being and low ethnic identity were predictors of imposter syndrome.

Cohen and Garcia (2008) investigated the effect of stereotype threat, which they define as "a fear of confirming a negative stereotype about one's group" (p. 365). Stereotype threat is often experienced by members of a minority group, primarily gender or racial minorities. Stereotype threat increases mental load and raises stress levels, which

can decrease performance. Cohen and Garcia studied people faced with stereotype threats and identified two primary interventions. The first occurs during what they call the vigilance stage, and they found that it was effective to lessen participants' tendency to interpret experience as being caused by their social identity. For example, in their research with college students of different races, Cohen and Garcia found that students expressed self-doubt and a low level of belonging at similar rates regardless of race. When participants learned this, they were unlikely to attribute their self-doubt or lack of belonging to their race. The second intervention Cohen and Garcia found was during the threat-appraisal stage. This strategy was used when people interpreted a negative experience as being tied to their minority status. The intervention used self-affirmation to buffer the emotional impact of their experience. Cohen and Garcia found that coping with stereotype threat through self-affirmation not only increased performance in the threatened area but could also positively impact other areas of participants' lives. Cohen and Garcia found that affirming one area of a participant's life by telling them family is important to them, for example, positively impacted an unrelated area like their school or work.

Logel et al. (2009) conducted a multi-part study on male and female engineering students at a Canadian university to investigate social identity threat among female engineers when faced with sexist men. A social identity threat occurs when a social identity is perceived as being at risk of losing value in a situation. The authors hypothesized that in domains where women are negatively stereotyped like engineering and other male-dominated fields, interacting with a sexist man can trigger social identity threat. In the first segment of their study, the researchers found that men who scored

highly on measures of sexism behaved more dominantly and expressed more sexual interest toward their female peers. Logel et al. noted that no overt sexism occurred, emphasizing their hypothesis that subtle sexism is also dangerous. In the next phase of their study, researchers saw trends that men's behavior can cause women's underperformance. In the third phase of the study, the researchers found that women performed poorly when faced with sexist men, and the women reported higher levels of attraction to men who behaved in dominant and sexually interested ways. Logel et al. found that sexism impacted performance in math and not English, which supported their hypothesis that women are impacted by sexism in fields where they face negative stereotypes. The researchers also found no significant differences in women's attraction toward sexist men when comparing math and English performance. Logel et al. noted that, while women were not treated in overtly sexist ways, their attraction to men who are dominant or exhibit sexual attraction to them could reinforce sexism, further impairing a woman's achievement and success.

Shapiro and Williams (2011) elaborated on stereotype threat research and introduced the multi-threat framework to examine two types of stereotype threat. The researchers describe self-as-source stereotype threat as an experience that confirms a stereotype in someone's own mind about themselves or the minority group they represent. Other-as-source stereotype threat emerges when someone believes others might believe a stereotype about them or their in-group. Shapiro and Williams studied how these types of threats relate to girls' performance in math but noted how their research could be significant to closing the gender gap in all STEM fields. The

researchers described possible interventions like combatting internal negative attitudes and eliminating stereotypes girls perceive from parents and teachers.

Balancing Work with Life, Family, and Motherhood

Smith (2017) investigated the experiences of six African American mothers and principals of urban high schools to explore how societal expectations and stereotypes affect their work and family balance. Smith found that participants reported sacrificing time with family was a common challenge, aligned with the existing body of research. The researcher also noted that African American female principals tend to lead schools that are more challenging than those led by White female principals, further exacerbating the challenge of the work-family balance for female principals of color. Another struggle common among participants was transitioning from principal to wife at the end of the day. Participants shared pitfalls they had faced in being the leader at work and not emasculating their husbands by taking charge at home. Smith highlighted the need for African American female principals to have strong support systems. This finding holds significance for many minority group members hoping to balance work and family.

Bateman and Ross (2021) used the U.S. Census Bureau's American Community Survey data from 2018 and compared it to data collected during the COVID-19 pandemic to investigate whether the pandemic impacted working women. The researchers found that prior to the pandemic, working women struggled as single parents (15%) and lived in poverty (41%). Bateman and Ross found that one in four working women has at least one child under the age of 14. Additionally, 17% of working women rely on school or childcare to be able to work, compared to 12% of working men. At the height of the pandemic, the unemployment rate for women had risen 12% compared to less than 10%

for men. Unemployment due to loss of childcare during the pandemic was reported by women twice as often as men. Survey data on unemployment of parents with children aged 12 or younger was collected, and researchers found that 2.2 million jobs were lost by mothers, compared to 870,000 jobs lost by fathers. Researchers also found that prior to the pandemic, working mothers provided 50% more childcare duties at home than did working fathers. This finding was only exacerbated by the pandemic and subsequent reduction in available childcare, further disadvantaging working mothers.

Correll et al. (2007) researched how employers perceived pregnant women or women of child-bearing age. The researchers used actual employers in a two-part study to compare equally qualified women with different parental statuses and another to compare equally qualified men with different parental statuses. The researchers found that actual employers discriminated against mothers but not fathers and called this phenomenon the motherhood penalty. The researchers found that mothers were perceived as less committed and less competent, were held to higher professional standards, received lower salaries, and had a lower likelihood of being hired or promoted than equally qualified non-mothers and males. The researchers found that mothers were considered 12.1 % less committed to their jobs than non-mothers, but men were considered to be 5% more committed to their jobs if they were fathers as compared to non-fathers.

Hutt Cabello (2023) tested how stereotypes associated with future childbearing risk differ from stereotypes of current motherhood. The researcher used an online survey experiment to gather data from 713 hiring managers working in the United States. Hutt Cabello discovered that women were discriminated against for being mothers and posing a high childbearing risk, which the researcher defined as being likely to have children in

the future. The researcher found that hiring managers make assumptions about female applicants who are current mothers and pose a risk of becoming mothers. Women seen as future childbearing risks were viewed in the context of cost to the company, but these women were not seen as lacking competence or having less growth potential, which was a promising finding by the researcher. Hutt Cabello concluded that current mothers who also posed a risk of future childbearing faced the most opposition and stereotypes. These women were penalized in all aspects of costs associated with future childbearing, perceived to be riskier in all measures, including a long-term commitment to the job, seen as less promising and less successful at handling responsibilities, and seen as less reliable and less capable of fulfilling job requirements.

Summary

This chapter reviewed the current literature on women in educational technology leadership and other related fields. Also presented were an overview of gender inequality in STEM and leadership roles, highlighting the underrepresentation of women in technology leadership, educational leadership, and EdTech leadership. Research on both external and internal supports for women in male-dominated fields like technology was discussed and the external and internal hindrances they face in these environments were examined. Chapter 3 contains a detailed description of the methodology and design for this study, which seeks to discover the experiences that supported or hindered female CTOs in K-12 education.

Chapter 3

Methods

The purpose of this study was to investigate the experiences of women in K-12 EdTech leadership that supported or hindered the pursuit or fulfillment of the responsibilities of a CTO position. This chapter includes the research methodology used in this study. It is comprised of the research design, setting, sampling procedures, instruments, data collection procedure, data analysis and synthesis, reliability and trustworthiness, researcher's role, and limitations.

Research Design

A qualitative phenomenological research design was chosen for this study. Phenomenological research focuses on the lived experiences of individuals and is best suited for exploring the meaning individuals or groups apply to social or human problems (Creswell & Creswell, 2018). Lunenburg and Irby (2008) described phenomenological research as dedicated to clarifying specific phenomena through participants' eyes. Grounded in constructivist theory, phenomenological research explores the complex and layered views of participants as they seek to create meaning and understanding from their lived experiences (Creswell & Creswell, 2018). Thus, the researcher deemed a qualitative phenomenological research design as the best way to explore the unique experiences of women in EdTech leadership and address the research question in this study.

An interview methodology was chosen because qualitative research methods are used to explain, explore, and understand phenomena (Creswell & Creswell, 2018). K-12 EdTech leaders have been studied since 2013 through CoSN annual surveys. While gender disparity among CTOs has been a consistent finding of CoSN's quantitative

research over the last decade, there has been no corresponding qualitative research to explore the experiences of female CTOs.

While the interview is "time-consuming and resource extensive" (Lunenburg & Irby, 2008, p. 92), it was selected as the most effective method to learn about the meaningful career events female EdTech leaders have experienced. Creswell and Creswell (2018) stated that interviews offer historical information, allow the researcher to control the line of questioning, and are useful when participants cannot be directly observed. Semi-structured, individual interviews with each participant offered the best design for gathering data from female CTOs to address the research question in this study.

Setting

Bloomberg and Volpe (2012) stated, "This section describes and justifies the selection of the research setting, thereby providing the history, background, and issues germane to the problem" (p.11). Due to the limited number of female CTOs, the study was expanded outside of the researcher's region. The setting for this study encompassed the entire United States. The researcher's connection to the professional organization CoSN and online communications made this study possible.

Sampling Procedures

According to Lunenburg and Irby (2008), "sampling for qualitative research is almost always purposive" (p. 176). The sampling procedure for this study was a purposive combination of criterion sampling and snowball sampling: "selecting a few people who can identify other people who can identify still other people who might be good participants" (Lunenburg & Irby, 2008, p. 176). The participants in this research

were females in K-12 school districts in the United States who were currently working as a CTO or had retired from a CTO position within the last two years. The researcher gathered names and emails for possible participants through snowball sampling with CoSN members of the Diversity, Equity, and Inclusion (DEI) Committee and from expert panel participants.

Instruments

Creswell and Creswell (2018) described the interview protocol as an outline of questions with probes to ensure the interviews remain on topic and solicit thoughtful responses from participants. The interview in this study was designed to gather phenomenological data on participants' experiences in pursuing and fulfilling the responsibilities of a CTO position and allow participants a comfortable space to elaborate on their experiences in EdTech leadership. The initial interview protocol included four demographic questions followed by two interview questions with additional guiding questions.

Using interviews allowed the researcher to connect with participants, increasing the opportunity for robust conversation. Rubin and Rubin (2012) stated, "Responsive interviewing brings out new information, often of startling candor, and often suggests unanticipated interpretations. The freshness and depth of the interviews make them exciting to do and, later on, to read" (p. 7). The researcher designed interview questions that explored each part of the research question.

The first two questions focused on participants' backgrounds and motivations to become CTOs. The next four questions focused on experiences that supported participants. Those questions were further divided into questions about internal and

external supports, as well as supports that occurred while they were pursuing a CTO position or fulfilling the responsibilities of a CTO position. The next four questions were designed the same way as the previous four questions but asked participants about hindrances they experienced, both internal and external, as well as if the hindrances occurred during the pursuit or fulfilling the responsibilities of a CTO position. Probing questions were also included so the researcher had a consistent method of asking participants to elaborate; however, probing questions were only asked when a participant did not address the information in their initial response. The final two questions in the interview asked for additional information that could benefit the research and a snowball sampling question to gather more participants for the research.

The researcher also incorporated demographic questions that aligned with the CoSN annual survey. Knowing additional demographic information for each participant could also provide an opportunity to examine the collected data from a broader demographic lens. While this research focused on gender disparity in EdTech leadership, there are other underrepresented groups in the field, and findings specific to the experiences of women of color could be beneficial to further research.

The researcher utilized an expert panel to review the demographic and interview questions. The researcher contacted four expert panel participants via email solicitation (see Appendix A). Four female EdTech leaders across the United States participated as an expert panel. One was a retired CTO from a city in the upper Midwest, two were former CTOs from different suburbs in the Midwest, and one served for over 20 years as an EdTech leader in a city in the Southwest. Following the expert panel's response with

feedback on the demographic and interview questions, the researcher asked if the expert panel participants would be willing to participate in a mock interview.

After a discussion with her advisor and research analyst, the researcher reviewed the expert panel's feedback and made the following changes. The two demographic questions about race and ethnicity received mixed feedback, so the researcher deleted them from the demographics and added an interview question about being underrepresented as a woman in technology. Restructuring the question this way better aligned with the research question and allowed the participants to share any other experiences they may have had as a female CTO of color, for example. The third demographic question asking participants to identify their district's metro status was perceived as too complicated, but asking participants their state and district name for the researcher to identify metro status would have been too much of a disclosure. Thus, the researcher omitted that demographic question and instead used public information about participants' district metro status if that information added value to the study. Only one demographic question about years of experience remained, so the researcher added it as an interview question.

The expert panel provided several helpful suggestions for participants to elaborate on when asked about the external and internal supports they received. Hence, the researcher added and revised four probing questions for interview questions four and five. The first revised probing question made a distinction between formal and informal mentoring. That same question also asked about sponsorship, but the researcher created a separate question about sponsorship, so the question did not have multiple parts. The researcher added a probing question about the professional organizations that supported

participants. The last additional question asked participants to describe their mentor or sponsor and the impact he or she had on the participant. This question allowed the researcher to gather data on whether factors like the gender of the mentor or sponsor had an impact on the participant. Because of the additional probing questions, the researcher felt that the probing question asking the participant in general about the impact of the internal and external supports was now unnecessary; therefore, the researcher omitted that probing question.

Two expert panelists also participated in a mock interview. The first participant in the mock interview shared feedback that asking about external factors while pursuing a CTO position and then asking about the same external factors while she was fulfilling the responsibilities of a CTO position seemed redundant. The researcher discussed this feedback with her adviser and research analyst and decided to reorganize the questions so that all external hindrance, internal hindrance, external support, and internal support questions were together. The second mock interview participant shared that the organization did not seem redundant but that for most of the questions, her responses were no different when she was pursuing a CTO position or fulfilling the responsibilities of a CTO. The researcher discussed this feedback with her advisor and research analyst and further revised the interview questions to ask about the areas of internal and external hindrances and supports, with just a single follow-up question in each of those four areas asking if there were any differences from when they were pursuing a CTO position or fulfilling the responsibilities of a CTO. The revised interview questions are as follows:

1. Tell me about your professional background.

   a. If your background is in education, what certificates or licenses do you hold?
   b. If your background is not in education, what field and what certificates or licenses do you hold?

2. How many years have you served as CTO (or how many years did you serve as CTO before retiring)?
3. Why did you become a CTO?
4. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what external factors supported you?

   Potential probing questions:

   a. What education or certifications supported you?
   b. What training or professional development supported you?
   c. What professional organizations were you part of and how did they support you?
   d. A mentor is a colleague who has been in the organization longer and helps guide you. A Formal mentor is when you are assigned a mentor, and an informal mentor is someone you naturally gravitated to. What formal or informal mentoring supported you?
   e. Sponsorship is different than mentoring because a sponsor is a person higher up in the organization who champions your work, promotes you for challenging assignments, etc. What sponsorship supported you?
   f. Describe your mentor or sponsor and the impact they had on you.

g. Of all the external supports you shared, what was the most impactful external support?

h. Of all the external supports you shared, were there certain external supports that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

i. What external support would have benefited you while you were pursuing a CTO position?

j. What external support would have benefited you while you were fulfilling the responsibilities of a CTO?

5. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what internal factors supported you?

   Potential probing questions:

   a. What personal passions or interests supported you?

   b. What personal skills and abilities supported you?

   c. What personal values supported you?

   d. Of all the internal supports you shared, what was the most impactful internal support?

   e. Of all the internal supports you shared, were there certain internal supports that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

   f. What internal support would have benefited you while you were pursuing a CTO position?

g. What internal support would have benefited you while you were fulfilling the responsibilities of a CTO?

6. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what external factors hindered you?

   Potential probing questions:

   a. What barriers to resources like mentoring or networking have hindered you?
   b. What policies or practices within the organization have hindered you?
   c. What biases, stereotypes, or sexism have hindered you?
   d. Of all the external hindrances you shared, what was the most impactful external hindrance?
   e. Of all the external hindrances you shared, were there certain external hindrances that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

7. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what internal factors hindered you?

   Potential probing questions:

   a. What personal attitudes or feelings have hindered you?
   b. What past experiences or negative perceptions have hindered you?
   c. What aspects of work-life balance have hindered you?
   d. Of all the internal hindrances you shared, what was the most impactful internal hindrance?

e. Of all the internal hindrances you shared, were there certain internal hindrances that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

8. As a woman in EdTech leadership, how has being underrepresented or a minority impacted you while pursuing or fulfilling the responsibilities of a CTO position?
9. Is there anything else you can share to benefit this research?
10. Are there other female CTOs in K12 EdTech leadership you recommend for participation in this research? If so, please provide their contact information.

Data Collection Procedures

Permission to conduct the study was sought from the Baker University Institutional Review Board (IRB) committee on October 11, 2023. Approval was granted by the IRB committee on October 17, 2023 (see Appendix B). The researcher emailed 23 CTOs from across the United States listed in the CoSN member directory and invited them to participate in the study (see Appendix C). The researcher used snowball sampling to gather additional participants from the participants in the initial interviews.

Participants were sent an email solicitation letter (see Appendix C) with the consent form (see Appendix D). The researcher asked participants to email a signed consent to the researcher prior to the interview. The consent form explained that the researcher was conducting a study on the experiences of female CTOs in K-12 education, and their participation would take 30 to 60 minutes. Participants were informed that they could choose not to answer any of the individual interview questions, stop the interview at any time, or choose not to participate in the study. Each participant was informed that

the interview would be recorded and they would be assigned pseudonyms to protect their identity and privacy.

Upon receipt of the signed consent form, the researcher asked participants to schedule an interview time slot using Calendly. The researcher offered a variety of weekday, evening, and weekend interview time slots to increase participation. Participants were emailed interview questions (see Appendix E) prior to the interview. Participants were interviewed through the video conferencing tool Zoom. They were reminded of the details in the informed consent form at the start of the interview.

Interviews took place from November 16, 2023 to January 11, 2024. Each interview was recorded and transcribed using Zoom. Written transcriptions from Zoom were compared to Zoom recordings, and discrepancies were corrected. After the interviews were transcribed and corrected, the participant's transcript was provided for review as a member check. A member check is when participants review the transcript of their interview for accuracy (Creswell & Creswell, 2018). When each participant completed the member check, the researcher coded the recordings and transcriptions with pseudonyms and saved them to a password-protected cloud drive along with the consent forms. All data, including recordings, transcripts, and consent forms, were kept for three years after the dissertation was defended.

Data Analysis and Synthesis

According to Creswell and Creswell (2018), the wealth of data and the range of data sources can create a challenge for qualitative researchers. The goal of the qualitative researcher is to collect a range of accurate data and identify common themes among the findings. Interviews in this study were conducted and transcribed using Zoom. Rubin and

Rubin (2012) posited that systemic coding is imperative to ensure that the study's data is empirical and verifiable. Hence, the researcher used member checking and sent transcripts back to participants to confirm accuracy.

Creswell and Creswell (2018) described coding as the process of taking text gathered during data collection, segmenting sentences into categories, and labeling those categories with a term. Once each individual transcript was coded, the researcher organized codes in a spreadsheet to help identify themes within individual interviews and common themes among multiple interviews. The researcher developed and defined codes, then refined, reduced, and grouped them into broad themes. The themes discovered were initially organized into general categories based on the research question and then further disaggregated into specific themes that emerged. In addition, themes were analyzed for each individual interview and across different interviews to form theme connections (Creswell & Creswell, 2018).

Reliability and Trustworthiness

Creswell and Creswell (2018) stated that some biases in interviewing may occur, such as the presence of the researcher affecting the interviewee and the researcher unintentionally filtering individual interviewee's responses through personal views and perceptions. Creswell and Creswell (2018) also supported a social constructivist approach to qualitative research, viewing participants as experts and relying on their views to construct major themes. The researcher approached the interviews as unbiasedly as possible, collecting responses without making assumptions or drawing conclusions, and using guiding questions to clarify or solicit more information from participants.

Following the suggested validity strategies of Creswell and Creswell (2018), the researcher used member checking to increase the validity of themes and findings. The interview transcript was shared with each participant for review to ensure their responses reflected their thoughts as intended. In addition to validity strategies like an expert panel review, mock interviews, and member checking, the researcher examined her own bias and presented information without prejudice to make the research more realistic and valid (Creswell & Creswell, 2018).

Researcher's Role

Since the researcher is the key data collection and analysis instrument in qualitative research, it is vital to disclose the background, possible biases, and cultural experience of the researcher (Creswell & Creswell, 2018). At the time of the study, the researcher was an EdTech leader for a K-12 public school district outside Kansas City, Missouri. She held teaching and administrative certificates in K-12 education, bachelor's and master's degrees, and was a doctoral candidate in educational leadership. Because the researcher was a female with K-12 CTO aspirations, these factors could contribute to potential bias on the researcher's part when exploring factors affecting gender disparity in the field. The researcher strived to remain impartial and professional during the study to ensure objective data collection, data analysis, and formulation of conclusions. The researcher maintained an objective and professional attitude throughout the interviews. The researcher asked the approved demographic and interview questions and was prepared with probing questions to keep each interview and answers in the same format.

Limitations

According to Lunenburg and Irby (2008), the limitations of a study are not under the control of the researcher, and there may be factors that influence the interpretations of the findings. Although participants were contacted based on their gender and CTO status, the researcher could not control who voluntarily chose to participate. The researcher could not control the nature of interviews as self-reported data, which could be subject to bias, selective memory, dishonesty, and hyperbole.

Summary

This chapter provided a description of the qualitative research design utilized in this study. Explained in this chapter were the research design, sampling procedures, instrumentation, data collection procedures, data analysis and synthesis process, measures taken for reliability and trustworthiness, the researcher's role, and study limitations. Chapter 4 contains the descriptive statistics and the detailed findings of the study.

Chapter 4

Results

The purpose of this study was to examine the experiences of females while pursuing or fulfilling the responsibilities of a CTO position, including the external and internal supports they experienced, the external and internal hindrances they experienced, the most impactful support and hindrance they experienced, external and internal supports that they believed would have benefitted them during their career, any significant differences in supports or hindrances, when they were pursuing a CTO position versus fulfilling the responsibilities of a CTO, and the overall impact underrepresentation has had on their career. Presented in this chapter are the findings gathered from 13 interviews with current or recently retired female CTOs in K-12 school districts across the United States. Prior to a detailed discussion of the findings and themes that emerged from the study, an overview of demographic data for the study's participants is presented. Next, the themes that emerged from the participants' interview responses are discussed in relation to the study's research question. Finally, the chapter concludes with a summary of the findings from the study.

Demographic Statistics

For phenomenological studies, Creswell and Creswell (2018) suggested three to 10 participants as an appropriate number of interview respondents. In this study, 13 participants were interviewed. Participants in this study were asked about their professional background and years of CTO experience. Participants were not directly asked about their location or race/ethnicity, but participants disclosed this information in responses to interview questions about their experiences (see Table 2).

Table 2

Demographics of Participants

	N
Professional Background	
Business	2
Education	7
Business and Education	2
Information Technology (IT)	1
IT and Education	1
Years of Experience	
5 or less	5
6-15	4
20-30	4
Location in the United States	
Midwest	3
Northeast	3
South	5
West	2
Race/Ethnicity	
Asian American	1
Black or African American	3
Hispanic	2
White	7

Note. Totals based on interview responses from 13 participants.

When asked about why they became CTOs, seven participants responded that they wanted to have a greater impact, four mentioned that it was a natural next step in their career, three participants said they wanted to effect change or improve EdTech, and one was encouraged because she wanted to improve representation for women of color. Two participants said they became a CTO because their district had a need, and they were the most qualified candidates. None of the participants set out to become a CTO. Participants with 20 or more years of experience described having the title of technology leader or technology coordinator in the early years of their CTO career. Most participants' current district title was director of technology; however, some participants had other titles such as director of instructional technology, director of information technology, chief technology officer, executive director of technology, and chief information officer.

Findings

After conducting the interviews, transcribing the audio recordings, and member checking, the researcher reviewed each transcript and identified common themes among multiple participants. In total, seven major findings emerged from the study:

1. Professional networks were reported to be the most impactful external support.
2. Leadership was both a support and a hindrance.
3. Sexism and bias were the most impactful external hindrances.
4. Self-efficacy and a growth mindset helped participants mitigate internal hindrances.
5. Family support was vital.

6. Work-life balance was a common struggle.
7. Lack of representation was a common hindrance, and underrepresentation was viewed differently by women of color and White women.

These findings were common areas of experience within the diverse careers of the 13 participants. In the following sections are the participants' reflections on how the themes identified in these findings impacted them as they pursued or fulfilled the responsibilities of a CTO position.

Finding 1: Professional Networks

The insights gathered from the participants shed light on the crucial role of professional networks in their career journeys. Supportive colleagues played a pivotal role in participants' careers, with 11 participants emphasizing the importance of supportive interactions with professional colleagues in their districts as well as from those in external networks. Participant 10 shared, "I had really great fellow senior leadership colleagues and colleagues and peers in the associations I belonged in. They have been wonderful external supports." She then added that "being able to interact with your professional colleagues, being able to problem-solve together, being able to empathize with one another has been incredibly impactful." Participant 3 discussed an initial concern about connecting with colleagues as she transitioned from instructional technology to a CTO role:

> I was really worried because my close colleagues were the people in tech integration roles and training roles, and there's this idea that they are the superstars, right? They're sharing a lot on social media. They're really friendly,

> going to conferences, and there's just a lot of collaboration. I was really worried that would not be the case because the CTOs I know didn't seem that way.

However, Participant 3 found her new CTO colleagues to be equally supportive but in a more reserved way. "What I found is CTOs are not public about the collaboration that happens. It's behind closed doors or on Zoom calls. CTOs are really bad about explaining what we do and showing what we do" compared to instructional technology leaders or trainers.

Moreover, CoSN emerged as the most supportive professional organization, garnering praise from all 13 participants. Participant 7 recalled attending her first CoSN conference and how different it was from other national organizations of which she was a member. Participant 7 said, "CoSN was very much geared towards district leaders, and so it allowed me to really think through strategy." Participant 9 relayed, "I think CoSN has been probably the one thing that led me here and got me to where I needed to be as far as supports." Participant 11 called CoSN "really pivotal" to her success and discussed the valuable professional resources they offer to members:

> CoSN always brings out white papers or policies that they're suggesting, which really helped me a lot when developing policies for acceptable use agreements or policies regarding cyberbullying. It allows me the opportunity to walk into a meeting and present before the superintendent or the school board and be proactive instead of reactive.

Many participants also noted that connections they had made through CoSN had led to other leadership opportunities, like presenting at other conferences and serving in leadership roles, including the CoSN board.

Six participants also acknowledged the CoSN Certified Education Technology Leader (CETL) as an important professional certification in their careers. CETL is "the only certification program available to education technology leaders that bridges technical knowledge, understanding of the educational environment, leadership and vision, and the management of technology and support resources needed to integrate technology across the curriculum to advance student outcomes" (CoSN, 2024, para. 1). Participants shared earning their CETL helped them to fill gaps in their professional understanding, regardless of their diverse professional backgrounds. Participant 1 had an educational background and said earning her CETL increased her leadership and technical skills:

> There were other things about being a CTO that I didn't understand being a tech facilitator and working primarily with curriculum. That's one aspect of being CETL certified. But then, moving into the position and realizing how much I don't know about the technical, like understanding the infrastructure. I didn't have a lot of that experience, but I really expanded my knowledge of that.

Participant 7 expressed value in networking with other CETLs to continue her professional growth. "I've grown by leaps and bounds, but something that would be beneficial is more networking with CETLs across the nation. Larger, smaller, medium-sized districts would be helpful at this stage."

Furthermore, participants expressed an appreciation for the inclusive environment CoSN has created for its members. Participant 9 described how beneficial CoSN has been:

> CoSN was a big support, not just from the perspective of giving information about CTOs and what they do or with the CETL certification that I have, but also that's where we first started seeing women's groups and getting to find more people like me and connecting with others.

Participant 7 shared that she has struggled to find a local professional network but that CoSN is an inclusive organization for women of color, stating, "It can almost feel like an intrusion. Like I'm coming in, and I'm not a part of this. Outside of my district, I probably see more women of color at CoSN than I see anywhere else." Participant 7 compared CoSN to other EdTech organizations, noting that CoSN works hard to promote diversity, equity, and inclusion. Participant 7 explained how she feels CoSN supports and promotes underrepresented leaders: "CoSN has a very intentional effort with that. At other EdTech conferences, there are thousands and thousands of educators there, but limited amounts of African Americans in executive roles."

Mentorship and sponsorship emerged as a cornerstone of professional support. Seven participants recounted the positive impact of male mentors, and three benefitted from experiences with female mentors. Several participants described men who were their direct supervisors or men who were former CTOs as being impactful mentors. Participant 2 described the mentorship she received from her former CTO when he retired, and she stepped into the CTO position:

> The mentor that I had was the previous director that had just retired. I naturally gravitated towards him because he had been my immediate supervisor for the last 10 or 15 years. I was also able to learn from his example. He wasn't technically labeled my mentor, but he was a great leader and led by example. I just appreciate

> everything that he did for me. It was somebody that appreciated my work and promoted my work to others, which helped me quite a bit.

Informal mentoring was a positive experience for all participants who experienced mentoring. One participant shared about formal mentoring and described it as a negative experience. Participant 9 stated, "When I define mentor, it's people who help me learn and help me understand how to be better," and explained,

> I think back to the first time I ever heard 'mentor' was when I graduated from college, and you were assigned a mentor in teaching. My experience with mentors has been anything but that. I don't think mentoring in education is real mentoring, or maybe I just got a raw deal and never had a really good mentor. Instead, I have found mentors myself.

Likewise, Participant 7 stated, "I kind of appoint myself mentors."

While participants used the terms mentor and sponsor interchangeably, five participants cited support from female sponsors and four from male sponsors. Eleven participants used only the label mentor until they were given the researcher's definition of sponsor and asked specifically about sponsors as compared to mentors. For example, Participant 10 used the term mentor to describe a man who was a building leader in her district who recruited her for a technology leadership position in his building. She described "a pivotal moment in my career" when she was positively impacted by a mentor:

> That kind of mentor who would just kind of pick you out of the field and say, 'Hey, I'm going to give you opportunities to pursue something that you're

> passionate about, or that you want to get done, or that you want to learn more about.'

When given the researcher's definition of sponsor, the same participant said, "That's an interesting distinction." and then described a second male supervisor who had served as a sponsor. Participant 7 described female sponsors who had promoted her to present at major conferences but seemed reluctant to call someone a sponsor because that person's support had not resulted in "an actual job or position."

Participant 3 described how a mentor can also become a sponsor, and vice versa when she described a supportive female in her network:

> She told me, 'I love that you're here standing up, presenting to these men and showing them that women can do this, too.' She'd say, 'Oh, I have this panel with three CTOs, but I'm really looking for a female perspective, and I really want you to be a part of this conversation.' So, not only mentoring me but also being that person who would sponsor me to be a part of those larger conversations.

Participant 9 described her male and female sponsors as more encouraging than mentors: "They push. They see more in you than you see in yourself."

When looking at mentorship alongside representation, a majority of women of color expressed a desire to be mentored by other women of color. Participant 4 shared,

> I come from a traditional Hispanic family where we had very strong beliefs on what women should and should not do. I was the first in my large extended family to go to college. Like you're supposed to be at home. So, having somebody [who] would have understood my culture and my position would have been very helpful.

Participant 7 described having to look outside her district and outside of the technology field to foster mentor relationships with two other Black female leaders in her state.

Several participants expressed the lack of formal mentoring for people in leadership positions. Participant 9 stated, “Unfortunately, I haven’t had many of those mentors since becoming a CTO. I didn’t have any mentors to work with other than people who were in the same seat, nobody helping lead that work.” These participants discussed that mentors for school district leaders could be professionally and personally beneficial.

Participant 9 shared a realization after becoming a CTO: “I guess I don’t get a mentor anymore. I guess I am the mentor now. So that’s when I realized that I had a responsibility myself to do that for others, male and female alike.” Several participants shared that they actively mentor others. All participants who had no mentoring or negative mentoring experiences expressed the importance of being mentors to others. The importance of mentoring women of color was discussed by all Asian American, African American, and Hispanic participants and one White participant. Of those participants, one Black and one White participant also mentioned the importance of mentoring men of color.

Three participants disclosed that they never had a formal or informal mentor. All three participants shared that they would have benefitted from mentorship. Participant 11 stated, “Having a mentor is definitely beneficial because then you would have someone that you can share ideas with or somebody that you can bounce certain things off and get an idea of what you have to do,” and said having a mentor was the one thing that would have benefitted her in her career.

Additionally, vendor resources were acknowledged by three participants as a beneficial support. Vendor resources were described as offering networking opportunities and bringing innovative ideas to participants' work in education. Participant 1 stated, "Discovery Education has had a big impact on me instructionally. They have a huge network of educators across the country and actually across the globe that they used to bring people together every summer for an institute." Participant 11 commented on having a business approach to leading her technology department:

> You can pull things from what you read about what IBM is doing, what Lenovo is doing, what all these other companies are doing, and you can pull aspects of what they're doing and embed it within what you have in your PreK-12 institution.

Finding 2: Leadership

A CTO is the primary technology leader in a school district. Participants experienced various supports and hindrances serving as CTOs in district leadership positions. All participants shared positive experiences with continuing their personal and professional growth as leaders. Eight participants called themselves lifelong learners and described being self-taught and pursuing professional development in various forms, from being avid readers to expanding their technical skills through trainings and online courses. Seven participants said they enjoy a challenge and often seek them out. Six participants felt supported by positive self-talk to build confidence and combat self-doubt. Participant 10 described the importance of positive self-talk: "You second guess yourself. It doesn't help in building confidence when you're in the minority or you're the outsider. It was constantly something to have to lean into and battle against. So that's

constant self-talk." She elaborated that women of color could need this even more, stating, "Coming from immigrant parents, I had to deal with an extra layer."

All participants described having strengths that helped them succeed, but four participants mentioned StrengthsFinder specifically. StrengthsFinder, which Gallup has since rebranded as CliftonStrengths, is a strengths-based assessment developed by psychologist Don Clifton. It has been used since 1999 and is designed to help people "discover what you naturally do best, learn how to develop your greatest talents into strengths, and use your personalized results and reports to maximize your potential" (Gallup, 2024, "Learn How the CliftonStrengths Assessment Works" section).

Participant 7 stated, "I really believe in StrengthsFinder," and described how her top strengths of learner, individualization, connectedness, and intellection have helped her to be successful as an EdTech leader. Two participants shared that one of their top StrengthsFinder strengths is being restorative. Participant 9 said, "I want to do things that make things better. And I think that's part of the reason why I became a teacher. I wanted to feel like I was useful, and so that drives me." Participant 1 shared how restorative and adaptability strengths have helped her with a recent administration change and "trying to understand the philosophy of the new leadership, and where they want to go with things and being able to lead that."

Seven participants discussed the importance of confidence. Participant 5 described having confidence from her professional experiences and attributed some of her success as a leader to her confidence:

> I do have a lot of confidence. My own self-confidence comes through with my background and my knowledge. Just knowing that I had the STEM background,

> the coaching, and knowing that everything I did has led up to the role that I finally took.

Participant 8 described how her confidence led her to pursue the CTO position in her district and said, “I saw the need, and I felt confident that I could help. I felt very confident that I could definitely help fill the gap and make a difference.” Participant 12 related her confidence to being raised by supportive parents and said, “I attribute a lot of my confidence to my parents. I never felt like I was a failure with my parents, no matter what I did.”

Some participants discussed struggling in times when they lacked confidence. Participant 3 described when she first began her role as CTO and did not yet have confidence in her abilities:

> When I was first offered this job, I was definitely a little scared. There was a lot that I didn’t know, and I was worried about being able to prove myself, to learn enough, to learn quickly enough, to carry on conversations with my team, speak to the technical folks on my team. I wondered, “Am I really good enough?”

Several participants discussed increased confidence after gaining CTO experience, and some shared that they still struggle with confidence at times, even after years of CTO experience.

Transparency was another leadership trait discussed by six participants. Participant 8 described being transparent as vital to being trusted as a leader:

> I wanted people to trust me, but that meant that I had to lead by example. I had to be transparent, open, upfront, and I needed to ensure that I was prepared to tackle

> whatever issues that came to me and not sweep it under the rug. It's forced me to become a stronger leader.

Participant 10 reiterated transparency as a necessary leadership trait and indicated, "Being real and transparent, especially as a leader. People see that, and it really builds a lot more trust in those that have to lean on you or depend on you."

Seven participants described needing determination to be a successful CTO. Participant 2 said, "People know that I will keep going until a solution has been found. I don't give up on them. They know that about me and promote the fact that I like to help them out." She added that she believes her determination helped her attain her CTO position.

Six participants described empathy as another internal support leaders need. Participant 2 described empathy as one of her leadership strengths but stated that it was a trait that she sometimes felt people viewed negatively:

> Empathy has helped me go a long way … As a supervisor, empathizing with my staff and their personal issues. I don't think a lot of people did that for some of these people. I was told early on in my career that women led differently, and leading different than a man was actually a bad thing. I found that it definitely served me very well to lead as a woman, and I think my staff knows that I will always be honest and care about their personal needs.

Participant 11 stated, "My team is important to me, but not only for what they do or their skill levels, but they're important to me as people…as human beings." She elaborated that her employees have told her how much they appreciated being treated with empathy. When Participant 2 became CTO, she described how the technicians in her district were

perceived by teachers and staff as being very dismissive when they would fix a technical problem. Participant 2 said, “I never had that attitude. I loved explaining technology to people and letting them know that I cared for them and for the work that they were doing.” She described how her approach to the customer service aspects of the technology department helped improve the technology department and their relationships with district staff.

In addition to empathy, four participants described being inclusive and equitable leaders who value diversity. Participant 4 described being in a district that has diversity, equity, and inclusion initiatives and trainings for staff:

> The good thing is we talk about diversity, equity, and inclusion in my organization, so I feel like my people pick up on it because it’s been brought to everybody’s attention. They notice those issues, but there are so many places that don’t talk about it, so people don’t notice anything if it’s not done to you or if it’s done to others. I think once people call it out and have discussions at their workplace, then it’s better for everybody.

Participant 3 stated, “I will do anything to help someone else who may feel marginalized to feel like they belong and they have a place here.” Participant 13 described no longer attending her organization’s equity and diversity trainings because what is talked about is not put into practice by district leaders.

Being a CTO in a district leadership position also presents challenges. Five participants described facing leadership challenges due to issues in their districts, like unsupportive district leadership, restrictive district policies, not holding people accountable, or the technology department as a silo. Participant 1 described working for a

superintendent who did not want her to present at conferences because "he was very much about him going places and him being the face of everything. He didn't want anybody to outshine him." Participant 9 described frustration with her district maintaining the status quo:

> My district specifically is a higher performing district, so there wasn't anything someone else could tell them. We were always the best, and so any change was seen as, "Why would we do that? We already have great things." If we said we wanted to make a change, it was very superficial … When you are steeped in tradition, it does not benefit people who want to be innovative, and want change and want to make things better. It just perpetuates the same. I think that probably was my number one external force that worked against me.

Participants also expressed challenges with the technology department being a silo in their district. Participant 8 described needing more support from executive-level leadership to make teaching with technology more impactful for students:

> It would have been awesome if the district was on the same page. I think that in the realm of technology, you can't say you want your students to be college and career-ready if you're not enforcing it from everyone from the top down. Trying to do this and make this effort for this massive change, if it's not coming from all directions, it is impossible. We can't have curriculum talking about technology but not doing it. So that would have made a significant difference.

Participant 11 described how technology can be overlooked by district leaders when it comes to making educational decisions:

> As a director of technology, people tend to think of you a lot of times, not as a leader. They think you are a 'break and fix' person. They don't look at you as a person who has insight into doing other things.

She elaborated that her current district is the first district where she serves on the superintendent's leadership team. Participant 10 also discussed being included on her superintendent's leadership team and feeling valued and supported by how her superintendent "continually championed the work of a CTO. He definitely had a vision of how this particular role would impact the district as a whole."

Four participants discussed challenges as leaders when they had to make difficult decisions. Participant 4 described the challenge of having over 100 people on her technology staff and wanting everyone "to be happy to come to work" but knowing she had to make decisions that would never please everyone. She said it is hard "balancing all that and still being seen as human and caring. That balance is something that I struggle with." Two participants used the term "crucial conversations" and discussed how difficult it can be for leaders to have to coach ineffective staff members or reprimand their staff. Participant 4 described struggling with this leadership duty more in her earlier career as an administrator than she does now but suggests that being a female can sometimes make it more difficult. She said, "It's tough to have some crucial conversations with people that are older than you or men that have been in the organization a long time."

Finding 3: Sexism and Bias

Sexism and various forms of bias were the most prevalent external hindrances that participants experienced. Ten participants reported at least one experience being subjected to sexism from men, and many participants described multiple experiences with

sexism. Nine of those participants described hostile sexism from men displaying gender superiority through derogatory or dominant statements and actions. Participant 11 described experiencing varying degrees of sexism and bias and said, “I’ve had a lot of mansplaining happen being in technology. I have been overlooked. I have been spoken to in a derogatory way.” Participant 3 reported sexism as the most impactful external hindrance she had experienced in her career. She shared about multiple experiences with sexism and described how men “talk down to you. They don’t behave appropriately towards you, whether that’s looking down on you and not thinking that you should be the CTO. Sometimes it’s even more blatant than that. Sometimes, it’s borderline sexual harassment.”

Participant 2 experienced being the only woman in a technical meeting or training and described hostile sexism from men: “Male engineers just overlooked me and said, ‘Maybe she’s here to take notes.’” Participant 10 experienced sexist comments from school board members who “literally under their breath would say, ‘Well, that’s because she’s a woman.’”

Participant 9 used the term microaggressions to describe some of the sexism she experienced: “Every day. I hear it every day. ‘Women are too emotional,’ and lots of microaggressions. I heard it from my own staff, from vendors, from our leadership teams.” One participant described experiencing benevolent sexism from men displaying gender superiority through words or actions that seem positive but perpetuate the belief that women need men to help or protect them. Participant 1 stated, “It’s the little things like, ‘You can’t climb up on that ladder.’ Yes, I can. Or ‘Are you sure you can carry that?

I can carry that for you.' No, you don't need to carry that for me. I don't need you to do that for me."

Four participants reported experiencing sexism from women. Participant 4 recounted sexist comments from women like, "She just got her position because she's probably dating somebody," or "Oh, she's just a pretty face." She described wearing tops with high necklines to deter sexist comments and assumptions:

> All my life I've been super careful and conservative. Those comments hurt. 'No, I'm not here because I look a certain way. It's because I'm smart.' I've heard it from both women and men, unfortunately. To my face and not to my face. But I've heard it to my face from both, unfortunately.

Participant 8 experienced more sexism from women than from men in her district. She stated, "I think that it came more from the females when it came to women in technology. For example, our previous superintendent was a female, but she was looking for more males in the technology field."

Nine participants reported experiencing sexism from vendors. Participant 5 recounted feeling like vendors were treating her differently than men at a conference vendor area:

> Vendors were playing it down and simplifying what they were talking about, like dumbing it down to me. Once, I was with a female colleague of mine. We went up to talk to one vendor, and he called us something; I don't remember the exact word, but it was offensive the way he talked to us.

Six participants experienced being at the vendor area of a conference with a male employee and having vendors assume that the male was the CTO. Participant 9 said it

was common “to be approached by a vendor, and them go directly to one of my male employees and introduce themselves to them, assuming they were the CTO.” Participant 6 shared the same example of a vendor assuming her male employee was the CTO but added, “What’s markedly different is when vendors are women. It’s an entirely different experience. Female vendors acknowledge me and ask unassuming questions.” Participant 9 shared an example of turning down a vendor’s product, so the vendor wrote a letter to her school board “and basically told them that I am a nice lady. However, I am the reason why our kids are failing during COVID-19 because we were not using his product.”

Four participants described being negatively impacted by dismissive men but did not label or quantify those experiences as sexism. Participant 2 described male vendors that “dismissed you because you’re a woman. That’s happened quite a bit.” She also described technical men as being dismissive:

> [Technical men had] the reputation for many years that they were better. They would talk over people who didn’t understand technology or talk above them like, ‘Oh, you don’t know what you’re talking about.’ When I first started out, they would sit down at somebody’s desk to help them out and say, ‘Move.’ Like, ‘Let me do this. You don’t know how to do this. It’s too technical.’

Participant 10 described it similarly:

> I was written off like, ‘Your observations really don’t matter here.’ I’m thinking of one network administrator in particular that would just talk over me in our meetings. I would say definitely because I was a woman and one of the few women sitting at the table at the time. Or maybe, ‘You’re on the education side, so what you have to say is less important.’

She attributed her experience to being a woman and also not having a technical background.

Three participants discussed the importance of having a male ally who will speak up or act when females are faced with sexism, bias, or discrimination. Participant 10 described a time when she brought a proposal to the board of education, and a board member kept asking her questions about things she had already answered and explained,

> I then watched my fellow colleague lean over to say something to this board member, and then he stopped his questioning. After the meeting, I spoke to the colleague and asked him what he had said to the board member during the Q&A part of my presentation. My colleague said that he leaned over to assure the board member that what I was saying was true and credible and 'I think you can trust that she has vetted this.' I was surprised and asked him what prompted him to speak up. My colleague simply replied, 'He was questioning you because you're a woman.' I didn't see that in the moment and was glad that he saw that and stepped in as an upstander.

Participant 4 described the following experience:

> Some men, like my previous boss, are very supportive. I have some directors also, when they see that you're being talked over, or people aren't giving you a chance to talk, and they would say something like, 'Were you trying to say something?' Or 'I think she was trying to say something, guys.' They give you that that time, but that doesn't always happen. We need that ally, that person in the room that's paying attention to the room, that makes an environment supportive for women.

In that description, Participant 4 emphasized the difference between being supportive and being an ally. Participant 3 experienced a coworker being very disrespectful to her and would have benefitted from an ally. She said, “I expected that someone else would step in and say something, but I had to be the person to say, ‘You’re not going to talk to me like that, and there is no place for behavior like this.’”

Bias was another major hindrance for participants. Each participant reported experiencing gender bias as a female CTO. Participant 6 said,

> Being a woman in technology from 30 years ago to now, it’s barely better. Not a lot better, as far as getting respect. If I’m the only woman in the room, it’s those pressures over the past 30 years that still exist. It’s definitely an equity issue of not getting the same respect as men.

Some participants perceived some improvement in gender bias, but several participants felt similar to Participant 6 and reported experiencing little improvement in gender bias over the years.

Several participants also described experiencing other forms of bias. Participant 7 described experiencing racism. She said, “People are more likely to respect a White woman before a Black woman because it hasn’t been done. They haven’t seen it. It’s just rare.” Participant 11 reported experiences that were “very sexist and very racist.” Another participant recounted having to file a discrimination complaint with a federal agency because her superintendent and human resources department did not intervene when she reported that a coworker openly used racial epithets and repeatedly exhibited racist behaviors that made her feel unsafe in her workplace.

Participant 12 described bias because of her sexual orientation. She said, “Being a lesbian with that lifestyle, we still have to be careful.” She described district leaders who she perceived as judgmental or afraid of people who are different and said, “Some districts don’t want anybody with that image. There can’t be anybody different. They all have to look, walk, and talk the same.” She added that she felt accepted, supported, and valued in her current district, but she shared that many LGBTQ+ CTOs have not been as fortunate.

Three participants reported experiencing bias because of their nontechnical background. Two of those participants pinpointed that bias as the most impactful external hindrance in their careers. Participant 5 described how technical men had negatively impacted her career, and said, “These people in the same role who have that technical background and just think that they know more than you do.”

Two participants experienced bias because of their noneducational background. Participant 6 said, “The bias because I’ve never been on the instructional side is a huge bias.” She added, “From my perspective, there’s still this divide of ‘If you’re classified, you can’t possibly understand or support teachers because you weren’t one.” She shared that she would have benefitted from supports for classified staff who want to pursue district leadership.

Finding 4: Self-Efficacy and a Growth Mindset

Participants described various negative experiences and how those often led to internal hindrances. In the face of adversity, all participants described mitigating those internal hindrances with self-efficacy and a growth mindset. With every negative they experienced, participants described having self-efficacy because they believed in

themselves and their abilities and having a growth mindset because they viewed negative experiences as temporary obstacles they could overcome, and that negative experiences have taught them important lessons in leadership and life.

Seven participants described being hindered by the way they sometimes reacted to opposition. Participant 9 described being hindered by not letting things go:

> The inability to let things go and the inability to allow people to have their own thoughts on me. I needed to correct the record, and that is something that I've learned now is not my business. You can think what you want about me. I'm going to keep doing the work.

Participant 5 described being hindered by her desire to be liked by others, especially earlier in her career:

> I really like to be liked. I'm a people person, and that's really beneficial, but it gets in the way. I want to please everybody. I want to get consensus. Sometimes, there are just times where you just have to make the decision, and that's hard for me. I will say once you pass age 50, it becomes a lot easier, but earlier on, I think that that did hinder me.

Participant 11 described her internal reaction to meetings where people are talking over one another:

> I have a tendency of shutting down, and when I shut down, most times, I just say, 'Okay, fine,' and I don't get involved, and I don't participate. We live in a time and a culture where everybody is out for themselves and what they want out of something, and I don't have that perspective at all.

Participant 11 elaborated that, as a Hispanic woman, “I suppose that’s where my cultural difference is because I did not grow up to be argumentative and that I’m always right.”

Five participants reported being hindered by self-doubt. Participant one described questioning herself: “Am I doing a good enough job? Am I making sure that everybody else has what they need? Then, taking care of myself. Self-doubt is probably the biggest factor.” Several participants also described the same experience with self-doubt and internally questioning their abilities or effectiveness. Participant 3 explained the importance of addressing self-doubt and shared how colleagues supported her during those moments:

> There were a lot of external factors that were able to help me mitigate those times of self-doubt. Not that they didn’t exist. But if I was honest with myself and would address them internally and then looked around at all of those people who were also in my corner. They believed I could do it, and there was a reason that I was chosen for this position.

Participant 4 described self-doubt with over a decade of experience as a district administrator:

> It doesn’t matter how high you go, how many speeches or presentations you give, I still get nervous. I still doubt myself. I still question myself. Having more confidence at the right time. Not that I didn’t have confidence. I was confident, but you still question yourself.

In addition to self-doubt, three participants described experiencing imposter syndrome. Participant 4 described how experiencing sexism and bias led to self-doubt and imposter syndrome:

> It's devastating. Well, not devastating, but it does pull you back, and then you start that imposter syndrome or that doubt starts to kick in. 'Can I do this?' Things are going on in your mind about what you want to be perceived as. I used to worry a lot more about it, but it can really knock you back if it keeps happening because then you start to think, 'Maybe I don't belong here.'

Participant 4 elaborated that she experienced imposter syndrome more in her early career than she does now and offered advice for overcoming it: "You have to be strong and have those mentors, those people on the side that are telling you, 'You belong." Participant 9 also shared that, as she neared retirement, she experienced less imposter syndrome, but she still had that internal struggle:

> Someone told me once that I was intimidating, and that just makes me laugh so hard because I'm anything but! I don't know what I'm doing on any given day! I guess what served me well to some degree is that I can make my outside look a whole lot different than my insides.

Her anecdote defined imposter syndrome: others seeing you as powerful while you feel uncertain and like the authority you exude is only to mask your internal doubt.

Four participants described needing "thick skin" to overcome negative experiences. Participant 3 felt she benefited from "having a thicker skin about dealing with some of the people who didn't believe I could be CTO." She elaborated with an example and said, "I even had some male colleagues, some principals here in my district who would talk down to me. One of them, in particular, got pretty nasty." Participant 10 expressed the same belief: "You definitely have to have a thick skin when you're in

leadership," but explained, "Not a thick skin that you're hardened and angry, but that you know yourself well enough to understand what kind of boundaries to establish."

Five participants described stereotype reactance and being motivated to prove stereotypes wrong. Participant 1 said,

> I love to prove people wrong. I love the doubters in my life because they're the ones that I'm like, 'Yeah? Watch me.' So that's something I know about my personality. When people question whether I can do something, it kind of motivates me a little bit more to prove that I can do it…. When people question me and question my abilities, I tend to internalize that and just do better at what I do. That's a motivator. I like to prove a stereotype wrong.

Participant 3 described experiencing stereotype reactance when she is faced with sexism, saying, "It makes me fight that much harder to prove them wrong. Those people, I shouldn't care about what those people think, but it makes me work extra hard to be one of the best at this role."

Several participants described benefitting from resilience. Participant 2 described feeling frustrated that she could not change peoples' biases but refused to give up:

> I had to realize that there was always going to be somebody who believes that men are better leaders and better technology professionals. I had to realize that it was just the way it was going to be. I can't change that, and I have had to learn to get mad but then get over it. I feel that that has served me very well.

All participants described having resilience, whether they used that specific term or described experiences of not giving up or working harder to prove stereotypes wrong.

Participant 3 described “the resilience to get back up” when you faced obstacles and believed that might be the best predictor of success and longevity for female CTOs:

> If you can’t set that goal and then, spend the time and effort and energy working to achieve it, and then set a new goal, I don’t think you’ll last in this role. It’s constantly changing, so it’s the ability to be resilient, honestly. Maybe that’s the best predictor.

Participant 4 also described resilience as paramount to females attaining and succeeding in CTO positions:

> It can get overwhelming when you have to constantly prove yourself, and a lot of people just wouldn’t fight for that. Why bother when you keep getting looked over and keep getting talked over? No. Having that resiliency to keep telling yourself, ‘I belong here. I belong here. I belong here.’ You have to keep pushing, but I think for somebody else, it could really end it for them. They could bring you down and just stop you from going forward to what you really want to pursue.

She described her resilience and using opposition as a motivation to prove herself to others and added, “But then you realize that you have to do it more for yourself. People come and go.” She elaborated that challenging herself to always keep improving has been a healthier goal for her than working hard to try to combat naysayers.

Three participants attributed their ability to overcome hindrances to their spiritual faith and described faith as the most impactful internal support they have experienced. Participant 10 said she draws strength from her faith to “be able to face things that are uncertain.” Participant 13 stated,

> I'm an unapologetic Christian. I do not try to push off my beliefs on anybody, but I ground everything I do in that. I was created in God's image, and He made me exactly the way He wanted me to be with my talents and my abilities, and I need to share what I have. As an African woman, if you don't have some inner strength from somewhere, and mine comes from my faith, these people will beat you into the ground and making you feel like you are unworthy.

She described experiencing racism in passive and blatant forms and how harmful that is psychologically but said her faith in God has been the most impactful support.

Participant 12 also described the importance of being true to who God made her to be when she feared not being accepted for her lifestyle as a gay woman:

> I think it was when I got pregnant I finally said, 'Look, I'm pregnant. I have a partner, and we're going to raise this child. If you don't like that, I'm sorry.' And as soon as I really came out and let people know who I was, nobody cared. They liked me for who I was.

She described loving herself and showing love to those around her and said faith and prayer helped her to overcome insecurities and any experiences she had with bigotry.

Finding 5: Family

Family was a major source of support for participants. All but one participant mentioned being supported by family. Seven participants described spousal support. Participant 10 shared, "I was fortunate enough to have a husband who had a career with such flexibility that he ended up being the stay-at-home dad." Participant 2 attributed her career path to her spouse:

> My husband was actually a computer programmer, and he was the first one who initiated my interest in technology. I had originally been an English major, so going back to school for technology was something I never imagined myself doing. I give him all the credit in the world for saying, 'Yes, you can do this. This is something you can do. It's not that big of a deal.'

Three participants mentioned having older children who were supportive of their mother being a CTO. Participant 11 stated, "My husband is 100% behind me in everything I do. I actually have a son who is a software engineer. He was a CTO for a software company, and he's been really supportive about it" and identified family as the most impactful external support in her career.

Five participants attributed their professional success to parental support. Participant 1 said her parents always encouraged her to try different things and described having strong female role-models in her family. She said, "My mom went back to college to be a computer science major back in the '80s, so just watching her struggle with some of those things is a motivation trying to do better and make myself better." Participant 1 described a great aunt who worked in computer science for a university, and she added, "having two very strong, strong-willed, headstrong females in my life, and just watching them do more and more." Her grandmother was also a strong female influence in her life:

> My grandmother, when my mom was little, built her own house because she had three little kids, and her husband had left her, and so she built her own house. So, having those women in my life that showed that we don't need somebody to do it for us. We can do it ourselves. I actually went and worked rebuilding car engines before I finally got a teaching job and could follow the passions that I have. But

> you know, working on things and being able to succeed in a male-dominated world. I can do that. It doesn't matter if I'm a woman, I can do whatever they can do.

Similarly, Participant 4 described loving, supportive parents who taught her to have a strong work ethic:

> Coming from a Mexican household, my mom was always at home taking care of us, very sweet and a hard worker, too, with the cooking and the washing. My dad was always a really hard worker. He owned a tire and motor shop and worked long, hard hours so we could get what we wanted. I think I was supposed to be watching my mom, but I was actually watching my dad work so hard. It just sounded very intriguing because you set a goal, you work hard, you get there, and then you can set a bigger goal, and you achieve that, and you keep going.

Family relationships can also present challenges. Participant 4 described conflict when she pursued a career outside the norms of her Hispanic culture:

> I remember the first time telling my mom I wanted to go to college, and she was like, 'Why?' but I knew it was something that would lead to a better future. First, I went to school, but then I started working full-time away from my kids, and then I started traveling. I remember the first time traveling, and my dad said, 'Are there men?' I didn't tell him I was traveling with men because my boss was a man. My dad would have probably died right there. It was hard fighting the battle of my culture and knowing that I wanted to be respectful to my parents but also knowing that there was a greater future out there for me with something that they didn't understand. They tell me now, 'I'm glad you didn't listen to me.'

Finding 6: Work-Life Balance

Maintaining a healthy work-life balance was a common struggle for participants. Eight participants described the challenge of working hard to earn a CTO position or the long hours required to succeed as a CTO while also balancing time with their spouses and children. Participant 1 said, “Throughout the years that work-life balance, trying to make sure that I am being a good wife, I am being a good mom, I am doing all the things I need to do while pursuing different degrees or career choices” was a challenge. Participant 6 described having an unhealthy work-life balance early in her career:

> I was consistently working long hours to prove to others that I was worthy and could get it all done. So that was a bad work-life balance, but I have kind of backed off on that the last couple of years, and when I go home, I’m home.

Several participants shared similar experiences with establishing healthier boundaries later in their careers.

Multiple participants described sacrificing self-care to put the needs of their districts or families before their own. Participant 1 shared, “I don’t like to let any of those things suffer, so sometimes that internal drive of doing better impacts my ability to sleep or take care of myself. I’m trying to make sure that I don’t let any of the balls that are in the air fall down, and that’s been hard.” Participant 9 described having a long commute to work, spending over two hours in her car every day and said, “I had a lot of food on the road. There were lots of things in my life I didn’t do to take care of myself.” Participant 11 recounted that earlier in her career of over 20 years as CTO, “nobody really cared about mental health.” Several participants expressed their satisfaction with the increased awareness of mental health issues in recent years. Participant 3 said, “having a safe space

where we can talk about those internal, mental health factors like that self-doubt or that imposter syndrome" has benefitted her personally and professionally.

Several participants also described how schools closing during the COVID-19 pandemic exacerbated their struggle with work-life balance. Participant 5 said that working from home and trying to support a child learning from home "was very distracting to me." She elaborated, "After you work these 80-hour weeks for a year you realize, 'I can't do that. I can't sustain that.'" Participants described being pushed past their limits during the pandemic and how that helped them finally set firm boundaries and establish a better work-life balance. Participant 4 described needing to show she was always available in order to get promoted within her organization but having to train herself to be present at home. She said, "When I'm home, I put my phone down and be present and pay attention to my family. Those are hard things when you're trying to run a department."

Four participants used the phrase "mom guilt" to describe the internal struggle they felt sacrificing time with their children for professional success. Participant 10 said, "I did have mom guilt, which was something that I had to reconcile every so often." She described how women "juggle a career and motherhood, or juggle being either the sole breadwinner or being the head parent in the household because you happen to be a woman."

Several participants discussed feelings of increased pressure or guilt because mothers were expected to be the primary parent. Participant 10 said, "My male counterparts really didn't have to contend with that, or it wasn't obvious that they needed

to contend with that challenge simply because they were men." Participant 3 described being at professional conferences and being asked where her children were:

> That's a struggle, so it's gotten to the point where, when people ask me that, and they're almost always men, I ask them where their children are. They say, 'No one's ever asked me that before,' and I say, 'Well, that's because you're not a mom. That's the difference between you and me is that people expect me to be the one who is the primary parent.'

Participant 4 discussed cultural struggle and how her Hispanic family had a negative opinion of mothers being away from their families. She said, "It was really hard navigating that early on, hearing 'You should just stay home with your kids.'"

All participants had children, and several discussed how their child's age impacted their career. Participants with older children or who were empty nesters reported experiencing less struggle with balancing their career and parenting duties. Participant 9 felt that having young children would make it impossible to succeed as a CTO:

> The only thing that saved me during my time as a CTO is that my son was a teenager and could manage himself. If I had a young child, there's no way I would have survived as a CTO. There is an expectation that you are always there, you're everywhere, and you are willing to put in the hours way past what's reasonable.

Participant 4 shared a similar perception and said, "I don't have young children, but I do know other CTOs or aspiring CTOs that have young children. I don't know how you

would do it. You would have to have a really good support system. It would be very, very hard."

Three participants discussed experiencing the motherhood penalty. Participant 4 recounted returning to work after having a baby and not being included on a trip for a project she had helped lead. She was taken aback when her female boss told her she was not invited because she should not leave her baby for an overnight trip. She said, "She didn't even give me the opportunity or ask me if I wanted to go." She felt she "shouldn't have to explain this" because she expected her boss to be more inclusive of working mothers. Instead, Participant 4 suffered the motherhood penalty when other male coworkers or females with older children were not excluded from the trip. She said, "Anybody could have had something with their kids or an event. That should have been my decision to go or not."

Participant 7 described currently trying to have a baby and the internal struggle with avoiding the motherhood penalty:

> We want to have a baby. We're actively trying. Not a day that goes by that I don't think, 'Oh, my gosh! I have this plan in my head to be executive and chief, and how do I still do that? How do I still go to conferences?' That struggle is still there, but I'm reminding myself that we get through this first. Life will happen, and we will figure it out, and it's going to be okay.

Similarly, Participant 3 shared the same positive outlook when she recounted having a baby in her first year as CTO:

> I took my 4-week-old baby to a conference, and I presented with the baby carrier on and didn't miss a beat. I don't know that it hindered anything, but I do think

> people were very taken aback by a pregnant CTO or one giving presentations with a baby. It's not something that they're accustomed to.

She elaborated that as more female CTOs retire and more young females join the ranks, professional organizations could do more to support women of childbearing age. She suggested having conversations to discuss "What is it like to be a pregnant CTO? What is it like to have a newborn baby as a CTO? What does that mean for your involvement in professional organizations?"

Two participants discussed the struggle of being single mothers while serving as CTO. Participant 6 was a single mom for several years during her CTO career and described benefitting from a supportive network, including her parents, who helped her manage her parenting duties. She also reported feeling supported by her district:

> I was fortunate to be in a district that let me be a mom. I got to go to parent conferences, go to field trips with my son, and do simple things that impact your life and the life of your child.

Participant 2 shared a similar experience with feeling supported by her district to participate in her children's activities. She said, "I think personally being in technology in the private sector would not have allowed me that freedom. I think being in technology in education with people who cared about children definitely helped me."

Finding 7: Underrepresentation

Underrepresentation was a major hindrance for participants. Participant 13 understood that representation, and ultimately equity, begins with visibility and said, "You can't be what you can't see." She described beginning her career working for a major technology company and being the only woman, and usually the only person of

color as well. She said, “I was a rarity, and so that intrigued me.” Participant 2 said, “Being a woman in technology just didn’t fit. It just wasn’t something that was normal. I was very much in the minority.”

All participants described experiences with being the only woman in meetings or technical trainings. Participant 2 described such a meeting where the technical men assumed she was there to take notes for them. Participant 13 recounted a similar experience attending a regional meeting in her state:

> It was all men, and I walked in and the man leading the meeting glanced at me and said, ‘You can leave it right there on that table.’ He thought I was there to bring them refreshments. I walked on in, told them who I was, and said, ‘I’m here to attend the meeting.’ I proceeded to ensure that I engrained myself in that organization, and about six or seven years later, I was the chair.

Participant 6 said, “It’s hard to be the only woman in a meeting or training, and men being surprised when you ask probing questions or speak knowledgeably about a technical subject.”

Professional networks were discussed in Finding 1, and some participants described the lack of women in senior leadership and technology leadership as a barrier to having a female mentor or sponsor. Several participants expressed how they have or would benefit from networks of other women. Participant 10 said female CTOs “need an affinity group to lean on or empathize with.” Participant 9 said, “Having other women who can commiserate, who can help you problem solve, and who can listen is super helpful.”

Several participants who worked in other fields prior to working in education perceived the education industry as having more opportunities for and better representation of women. Participant 2 and Participant 4 both described education as being more collaborative and less competitive than the private sector, which improves the underrepresentation of women in EdTech leadership. Participant 10 said, “There’s a unique opportunity in the industry of education, where there are many more women in the workforce, and there are more on-ramps to leadership and to the field of technology.”

Participant 13 described moving into the education field from the private sector and seeing women in the majority:

> There are a lot of Black female teachers, and a lot of Black female principals, and a lot of Black female administrative assistants, and a lot of Black females doing other things. But when you got over onto the technical side, there weren’t a whole lot of people that look like me. And I thought, ‘Wait a minute. I can do this. I am doing this. I’m actually pretty good at this. It can’t be that I’m the only Black female that has the ability to do this type of work.’

She shared that by working with teachers and students, she was able to represent women and people of color in technology, and even had middle and high school students ask her about her career path because they were interested in working in technology. She said, “I may be inspiring other females or other young people of color to pursue technology and see it as a viable career path.”

When asked about underrepresentation in general, White participants described positive outlooks. Participation 5 described being underrepresented as empowering:

> It's empowered me because of the things I'm starting to advocate for and see and do. I find it's a place that I can encourage other women to be in these types of roles, whether it be a tech director or an instructional coach leader. I just feel like it's something that I can grow and empower people in their technology skills, too.

Participant 1 perceived that the underrepresentation of women has improved and said, "Maybe we're getting to a better place, or maybe it's just I'm in a good place." Participant 2 stated, "I do believe that things are getting better, and that I almost feel like the younger generation is much more apt to see women in roles like this."

Women of color, on the other hand, perceived little to no real improvement in underrepresentation. Participant 13 described frustration with how little improvement has been made for women of color during her CTO career of over 20 years:

> In the year 2024, this stuff is still happening. These disparities and these discrepancies are not just figments of our imagination. They're real, and they're harmful, and until we are intentional about fixing the issue, it's going to continue. It's not going away.

Participant 11 echoed those feelings and said, "I don't care what anyone tells you right now, where we see this significance of females and minorities being leaders in technology. It is still not accepted. We are still not there."

Three White participants spoke as allies and acknowledged the additional disparities experienced by people of color and the LGBTQ+ community. Two participants who lived in the South expressed their concerns with current politics. Participant 9 shared concern about the risk of losing the progress that has been made for underrepresented groups:

> What I'm most concerned about right now is the systemic problems that are facing not only women but people of color. In the way our educational system is built people believe that it's serving everyone well, and it's not serving a lot of people well. We have a Parents' Bill of Rights now, and all of a sudden, we can erase whole groups of people, and we can treat them differently. So, trying to figure out how to best serve others and finding ways to educate people without them thinking they're being indoctrinated.

Participant 3 described advocating for women and being an ally for other marginalized colleagues:

> I will do anything to help someone who may feel marginalized in this role to feel like they belong and they have a place here. Whether that's a younger or newer female or the full LGBTQ+ section of CTOs that we're not often talking about. If people feel marginalized, I guess it just makes me resolve to stand up for all those people and to be that support because it takes all voices.

Several women of color discussed the positive impact advocates and allies have had in their lives as students and how that has positively impacted their careers. Participant 10 recounted an experience from eighth grade when she began expressing her cultural diversity through writing, and how her White teacher positively impacted her:

> Being of an immigrant background, being a person of color in those moments, the power of a teacher for me as a student was just life changing. It helped me understand that I am diverse and to take more pride in that. Her recognizing and celebrating the fact that I was different was life-changing.

Participant 4 also described the importance of representation and advocating for immigrant students. She said, “When I started school here, I only spoke Spanish. So, I see that a lot, and I see myself and these kids. That’s a big motivating factor for me to be here and do well.” She added that she always speaks at school career days “so kids can see that there are people that look just like them in these positions and that it’s possible.”

Several women of color expressed the desire to be recognized and acknowledged for their contributions as hard-working, intelligent, successful CTOs as opposed to being a woman of color who is also a CTO. Participant 7 described experiencing tokenism, but she did not use that term:

> Because I’m a Black woman, people are vying for that. Sometimes, it feels like a checkbox they want to fill, as compared to them wanting my knowledge and expertise. I have to go in game-ready to share the work that’s going on in the district or work that I’ve done personally to get that validation. I think it is different for White males because it’s not a question of if they earned it or if they’re knowledgeable. They just get validation.

A majority of participants perceived having to work harder than their male counterparts to be seen as competent, and women of color reported feeling this to an even greater extent.

All African American participants described feeling pressure to be perfect because they perceived that any mistake they made or weakness they showed would reflect negatively on all people of color. Participant 7 described being more cautious and strategic than her White counterparts:

> For African American women, especially, I feel like I have to sit in my head a lot more than my counterparts. I have to really evaluate a thought or action instead of just jumping out. I feel like White people don't have to live in their heads as much. They can make a decision and run, whereas I feel like I have to think through consequences on a deeper level.

Participant 8 described the same experience as a Black woman:

> There was added pressure as a Black female. I'm not sure whether it was coming from me internally or if I felt that it was actually coming from externally, but there was definitely extra pressure to make sure that I was toeing the line, so to speak. I was really representing Black females in IT or the Black culture in general. There's always that added pressure that I feel that as a Black female that you have to be twice as good to be considered good.

She described having many conversations with other Black women and men who feel like "you're measured by a different measurement tool" and perceived that Black men experience this even more than Black women.

Participant 13 said, "Let's just say that if I made some of the same mistakes that my White colleagues have made, I would not still be here." She described how, after nearly 30 years as an EdTech leader, she has embraced speaking her truth and not staying quiet about racism and bias:

> I used to be more careful about how I raised an issue because I didn't want to come across as the angry Black woman. At this point in time, I don't care if people think that I'm an angry Black woman or not. These are the facts. This is

> what happened. This is what continues to happen, and if you want to paint me as the angry Black woman because I have come out and said it, then so be it.

She shared a powerful message for Black women and men who feel pressured to be perfect and said, “I have to take that off my shoulders. I’m doing the best job that I can, and I am not going to allow these people to continue to put the mantle of the whole Black race on me.”

Mentorship and sponsorship were discussed in Finding 1, and all participants perceived mentoring as valuable. Regarding underrepresentation, several participants mentioned mentoring as a possible solution to lessen the gender gap. Multiple participants shared examples of mentoring others, and the two participants who reported never having experienced mentoring themselves also shared how they actively mentor others. Participant 11 said, “We should look for opportunities to mentor young women and minority women.”

As discussed in Finding 1, all Asian American, African American, and Hispanic participants and one White participant reported the importance of mentoring women of color. Participant 13 described the need to be intentional in recruiting and hiring to build a pipeline for underrepresented individuals. She said, “Possibly build on looking at ways of creating mentorships and ways of creating opportunities. When we talk about diverse hiring, we talk about the pipeline. How exactly do you build up that pipeline?”

Several women of color discussed the importance of having a mentor of the same race or ethnicity, while White participants did not discuss race when describing their experiences with mentors. Participants who were women of color described the benefit of having mentors who were different from them at a much higher rate than White

participants. Participant 11 did not believe having a mentor of similar age, gender, or race mattered because she “can learn from everybody, no matter what.” Participant 7 said, “I think there’s power in listening and hearing from people who don’t believe like you do.”

Summary

Presented in this chapter were the findings of interviews conducted with 13 female CTOs based on interview questions tied directly to the research question for this study. The participants articulated experiences with external and internal supports and external and internal hindrances. From these responses, seven findings emerged based on recurring themes and concepts expressed by the participants. In Chapter 5, a study summary, findings related to the literature, and the conclusions are provided.

Chapter 5

Interpretation and Recommendations

The focus of this study was on female chief technology officers in K-12 education and their experiences with external and internal supports and external and internal hindrances during their pursuit or fulfillment of the responsibilities of a CTO position. Chapter 5 builds upon the findings presented in the previous chapter, providing interpretations and recommendations. This chapter includes a study summary, findings related to the literature, and the conclusions.

Study Summary

The following sections provide a summary of the study. First is an overview of the problem, which provides context to underscore the central issue of the study. Next is a presentation of the study's purpose statement and research question. The next section includes an overview of the research methodology used in the study. The section concludes with the major findings of the study.

Overview of the Problem

There is limited research on people in K-12 EdTech leadership positions. The existing quantitative research exposes a gender gap that has not changed significantly in at least the last 10 years (CoSN, 2023). The existing research does not consider the experiences women in K-12 EdTech leadership had that supported or hindered them in the pursuit or fulfillment of the responsibilities of a CTO position.

Purpose Statement and Research Question

The purpose of this qualitative, phenomenological study was to explore the experiences of female K-12 EdTech leaders and discover who or what supported or

hindered their pursuit or fulfillment of the responsibilities of a CTO position. Participants were asked about internal supports like personal abilities and external supports like professional organizations, which helped the researcher understand their experiences. Likewise, details about hindrances, such as barriers to resources, inequitable policies or practices, and biases, stereotypes, or sexism, helped the researcher understand any negative experiences and how those impacted participants. The study was guided by the following research question: What experiences have women in K-12 EdTech leadership had that supported or hindered the pursuit or fulfilling the responsibilities of a CTO position?

Review of the Methodology

This study was structured with a qualitative phenomenological research design. The researcher utilized a semi-structured interview with open-ended questions and additional probing questions if follow-up was needed. The setting for the study encompassed the entire United States due to the limited number of female CTOs available as potential study participants. Due to the qualitative nature of the study, purposive sampling was utilized to identify potential participants. The researcher also used snowball sampling to identify additional study participants. The researcher conducted interviews using the video conferencing software Zoom. The transcripts of the interview recordings were shared with each participant for member-checking. The researcher then analyzed the member-checked interview transcripts, identifying common themes within the responses. From these themes, the researcher identified seven major findings.

Major Findings

The researcher used open coding to identify themes aligned with the research question in individual interviews. The researcher organized individual themes, reviewed them, and consolidated overarching findings that emerged among all participants' responses. In total, seven findings emerged from the study:

1. Professional networks were the most impactful external support.
2. Leadership was both a support and hindrance.
3. Sexism and bias were the most impactful external hindrances.
4. Self-efficacy and a growth mindset helped participants mitigate internal hindrances.
5. Family support was vital.
6. Work-life balance was a common struggle.
7. Lack of representation was a common hindrance, and underrepresentation was viewed differently by women of color and White women.

Findings Related to the Literature

So far in 2024, there has been little research focused on female CTOs in K-12 education, but the quantitative data from annual CoSN surveys highlights a gender gap in the CTO position that has decreased from 36% female CTOs in 2016 to 33% in 2023 (CoSN, 2023). Supports for underrepresented groups have increased over the last decade, so the widening of this gender gap is puzzling. The focus of this study was on the experiences of female CTOs to provide qualitative data investigating the enduring gender gap. The findings of this study will now be compared to the existing literature presented in Chapter 2.

Finding 1 was related to professional networks and included the topics of colleagues, CoSN and CETL, mentors, sponsors, and vendor resources. Kram (1988) found that male mentors offer career functions while female mentors offer more psychosocial functions. In this study, Participant 3 described having a male and female mentor who offered different types of supports. Participant 3 described her female mentor as "encouraging" and "always in my corner" and described her male mentor as "a model of someone doing great work…hard work" and said he introduced her to other leaders in and out of the state. Participant 4 described similar differences between her male and female mentors:

> I think, as a woman, sometimes we second guest ourselves. Am I being like what the stereotype says? Bossy and mean? Or am I just getting in my head? I think having those female mentors is what helps. My current boss is a male, and he's great. I can go to him for technical advice or other advice with staff issues, but I think having those female mentors a phone call away has been instrumental.

The findings in this study support Kram's (1988) findings, as several participants described having male mentors who supported their career functions, while their female mentors supported more emotional and social functions.

Noe (1988) studied the effect of mentor gender on women working in male-dominant fields and found that women with male mentors worked harder to avoid common pitfalls of cross-gender mentoring, resulting in a more successful mentorship. In this study, Participants 3 and 4 both discussed the importance of a professional appearance, and Participant 4 shared how she is always "careful and conservative" to avoid colleagues assuming any impropriety. Noe also found that women are more likely

to use mentorship effectively because they recognize how mentoring can benefit their careers. Noe's findings are once again supported by the current study's findings, as all participants discussed the importance of mentoring, and while no participants had been assigned mentors as CTOs, 11 of the participants had sought out their own informal mentors.

This study found that women of color valued having a mentor who was also a woman of color, which supports the findings of Dreher and Cox (1996) and Blake-Beard et al. (2011). Researchers have also found that women with male mentors earn higher salaries and higher-level positions than women with female mentors (Burke & McKeen, 1996; Dreher & Cox, 1996; Ragins & Cotton, 1999). While data on salaries were not collected in the current study, it is notable that the women in this study with more prestigious titles like chief technology officer, chief information officer, or executive director of technology reported being mentored by men. Ragins and Cotton (1999) also found that informal mentoring is more impactful for women than formal mentoring. In the current study, all participants described numerous benefits from having informal mentors, and one participant had experienced formal mentoring that she described as a negative experience, which supports Ragins and Cotton's (1999) findings.

Women's leadership programs and other strategies focused on female leadership have been proven to increase women in leadership in the technology field (Awodogan, 2023; Mann, 2021). The participants in the current study did not report being a part of female leadership trainings but reported benefitting from aspects like mentoring and professional development. Furthermore, four participants in this study identified having more affinity groups for female leaders as the one external support that would have

benefitted them most. Awodogan (2023) found that work-life balance is a particularly difficult aspect for women in leadership, which is supported by this study, as eight participants discussed work-life balance as a major obstacle in their careers.

Finding 2 in this study highlights the leadership and the challenges and benefits experienced by CTOs as their district's primary technology leader. A possible reason why fewer women pursue technology and other STEM fields has been identified as women's desire to have careers that do social good, are people-oriented, and help others, which is not typically associated with those technology or STEM careers (Lewis et al., 2019; Petersen, 2014; Sax et al., 2017). The current study's findings support those previous findings. Participants 4 and 10 began their professional careers in business, but both commented on how they enjoyed the collaborative nature of working in education. Multiple participants described positive experiences working with teachers and students. Participant 11 described a teacher who postponed her retirement after the participant helped her get new technology into her classroom and said it was worth her "entire career" to have an impact like that on a teacher. She also described working with students as a major benefit of her position and said, "I love to see when the kids develop these skills and have the ability to get beyond school and having an impact outside of school. Seeing success stories from the kids." These findings support Lewis et al. (2019), Petersen (2014), and Sax et al. (2017), as the participants in this study were pleased that their careers helped others and did social good.

Burrell (2017) found that a major barrier in hiring women for CIO positions was that institutional management teams responsible for hiring thought CIOs should have a technology degree. Burrell (2017) discussed the importance of recruiting women with

other valuable skills and backgrounds and then providing them with any necessary deeper technical training to fulfill a CIO position. CoSN (2023) found that those in charge of hiring CTO positions in 2023 are less likely than they were in 2013 to see a technical background as a requirement for fulfilling the responsibilities of a CTO, which could be a leadership hiring trend that benefits females. The findings in the current study support those from Burrell (2017) and CoSN (2023). Most participants in the current study did not have technical backgrounds. However, many stressed the importance of leadership skills over teaching or technical skills, and six participants praised the CETL, a professional certification showing equal mastery of education, technology, and leadership skills.

Thomas's (2005) findings are also supported by the findings of the current study. Thomas found that females are often unlikely to pursue computer science in school but decide to pursue the IT field after being encouraged by teachers. The participants in the current study did not set out to become CTOs, and many described never having considered it as a career path until a supportive person in their life encouraged them to do so, which supports Thomas's findings. Additionally, this study's findings support Thomas's finding that women report high levels of job satisfaction but often feel isolated as women in a male-dominated field.

The current study's findings also support the findings of Simard et al. (2008) in that professional development benefits all members of the technical workforce; however, women may benefit more due to having fewer technical certifications and degrees, as well as benefitting more from professional networking than men. While the impact of professional development or networking on men was not compared in the current study, it

was found that professional networks, including professional organizations like CoSN and resources from those organizations and other EdTech vendors, were the most reported and most impactful external support for participants. Additionally, the majority of participants in this study had few or no technical certifications or degrees; however, many reported pursuing technical trainings and other external supports to further their professional development, which also supports Simard et al.'s finding.

A major hindrance identified in Finding 2 was the challenge of not feeling supported by district leadership, policies, or practices. Anderson et al. (2013) studied women working in the private technology sector and found that only 25% of participants perceived their organizations provided adequate support for their professional growth and advancement within the field. Many participants in the current study described feeling unsupported by district leaders or restrictive policies. Additionally, participants described limited professional growth or opportunities. Participant 9 described having to wait her turn to finally achieve a CTO position, and Participant 7 described leaving a district she loved in order to gain experience in a technology position before being able to "come home" once a position was available in her previous district. These findings support the findings of Anderson.

Finding 3 centered on sexism and bias being the most impactful external hindrances, which supports the findings of Reicher et al. (2019), who found that women faced challenges in advancing to leadership positions due to stereotypes and biases that undermine women's confidence and performance and deter them from pursuing leadership. The participants in the current study reported a high number of experiences with sexism and other forms of bias like racism and heterosexism, and all described how

those experiences had lasting effects on them personally and professionally. Reicher et al. also found that female leaders are more like to face backlash for raising ethical concerns or objections to immoral practices or actions in their organizations. Reicher et al.'s finding is also supported by the findings of the current study, as participants described being accused of being overly sensitive or too emotional when dealing with inequities. One participant filed a discrimination complaint with a federal agency after her district leadership ignored her reports of overt racism in order to protect herself from a hostile work environment and subsequent backlash due to her reporting of it.

McDonald et al. (2004) studied the effect of status on leaders from underrepresented groups and found that women with higher status, like age or experience, had fewer negative interactions when leading men in male-dominated workplaces. The finding is not supported by the findings of the current study. Two participants were both African American women with nearly 30 years of experience in the field, and one had mostly positive experiences leading men while one had very negative experiences. While this study had only 13 participants and their ages were not recorded, the participants with the highest years of experience shared the same types of negative experiences leading men as the participants with the fewest years of experience. Thus, McDonald et al.'s findings are not supported by the findings of the current study.

Participants in the current study described experiencing sexism and bias from other women. This finding supports the findings of Carbado and Gulati (2004) and Kaiser and Spalding (2015) who found that members of underrepresented groups will sometimes actively work against members of their same underrepresented in-group. Participants in the current study described the importance of supporting other women, and the four

participants who had experienced sexism or bias from women seemed particularly discouraged by those experiences. Participant 5 described a sexist experience and used that opportunity to raise awareness with her colleagues:

> I want to be sure that it doesn't affect other women because sometimes, even other women are not supportive. I have some new colleagues who seem cold and unresponsive when we're in meetings, and I don't know if it's really that, but I think, 'Oh, my! I really need to be aware of this on my own level and make sure that I'm not doing that.'

Participant 4 described disappointment and even shock when she shared about two different experiences with women treating her in a sexist manner. Therefore, the findings of the current study support the findings of Carbado and Gulati (2004) and Kaiser and Spalding (2015).

Zenger and Folkman (2020) studied the effectiveness of female leaders compared to male leaders and found that women were rated as more effective overall and more effective during a crisis. While this study did not collect any data from male leaders, several participants described their leadership styles as being different than male's style. They perceived their leadership styles as effective, indicating support for Zenger and Folkman's findings. Participant 2 described transforming the way her technology department supported staff into a more respectful and caring customer service model than was used previously and said that it has "definitely served me very well to lead as a woman" because her staff knows how honest and caring she is.

Finding 4 was how self-efficacy and a growth mindset helped participants mitigate internal hindrances. Social identity threat and stereotype threat are two

psychological phenomena experienced by some people in marginalized groups when faced with opposition like sexism or racism (Cohen & Garcia, 2008; Kray et al., 2004; Logel et al., 2009; Shapiro & Williams, 2011). The current study's findings support Cohen and Garcia's (2008) and Shapiro and Williams's (2011) findings that self-affirmation can reduce negative attitudes and mitigate the impact of stereotypes or social identity threats. Participants in the current study described experiencing forms of bias that made them feel self-doubt. Participant 3 described the difficulty of being a woman in a male-dominated field and the isolation and self-doubt that can cause but described how she would "address that internally" and then also bolster her confidence through other external supports. Multiple participants discussed the importance of positive self-talk. The current study's findings also support Cohen and Garcia's (2008) intervention of the vigilance stage, where lessening the perception that your social identity caused a negative experience reduces the level of threat. Participant 1 stated, "There were several jobs I didn't get, but was it because I was a woman? I don't know. It did make me want to work harder for it, but I don't know that being a woman impacted that." Statements like these support Cohen and Garcia's (2008) finding that the vigilance stage can also lessen stereotype and social identity threat.

In addition to internally reacting against stereotypes or social identity threats, many participants in the current study took external action. All participants described having resilience in the face of challenges, but six participants specifically described using others' doubt or bias as a motivator to prove people wrong. This finding supports Kray et al. (2004), who found that women faced with an explicit stereotype can achieve stereotype reactance or overcome the stereotype by acting against it, which can lead to

additional internal and external benefits. The current study's findings also support Logel et al. (2009), who found that sexism does not have to be overt and subtle sexism is equally dangerous. Participants in the current study described numerous experiences with sexism that hindered them. While some did not always label these experiences with the term sexism, the experiences had negatively impacted participants to such a degree that many disclosed experiences that had occurred decades prior.

The findings from Petersen's (2014) study on women in STEM and Wiggins's (2021) study on female CTOs did not refer to stereotype reactance. However, the researchers found that women felt motivated by obstacles and worked harder to overcome them, which was also a finding in the current study. Mootry (2018) found women in senior-level technology positions also described actions and behaviors indicative of high self-efficacy and identified women as being reluctant to use self-promotion. Since Participant 10 stated that her most impactful internal hindrance was not promoting herself, Mootry's (2018) findings are supported.

The current study's findings emphasized the tendency for female CTOs to have internal traits like confidence, determination, and resilience, which helped participants overcome the many challenges of being a CTO. This finding supports findings by Dennehy and Dasgupta (2017), Mootry (2018), and Wiggins (2021), who found that women in technology leadership and other STEM fields often exhibit high levels of self-efficacy and a propensity to be motivated by challenges. Additionally, participants in the current study also discussed the importance of supporting other women's sense of belonging in the field of EdTech, which supports another finding by Wiggins (2021).

Finding 5 focused on how supportive family members have positively impacted female CTOs. Jung et al. (2017) studied why women and men pursue technology majors in college and found that women are more likely to pursue technology if they are encouraged and supported during their school-aged years. The findings in the current study support Jung et al. (2017) because five participants described the positive impact their careers have had due to having supportive parents from childhood into adulthood. Smith (2017) found that African American women in principal positions struggle with balancing work and family due to stereotypes and societal expectations. The current study's findings support a struggle to balance family responsibilities as working mothers, but all participants described this struggle, not just the women of color or African American participants. Further, one woman of color described her husband supporting her as a stay-at-home-dad, which does not support Smith's (2017) findings.

Finding 6 in this study was that work-life balance is a common struggle for participants. Clark (2013) studied male and female CIOs in higher education and found that females reported spending more time on home-related duties than male respondents. Participants in the current study described the struggle to balance parenting with their careers. Participant 3 described that women are expected to be the primary parent, and Participant 9 described how challenging it is being a working mother, even with a supportive spouse. Thus, the current study's findings support those of Clark.

The pandemic exacerbated the challenge of being a working mother, which was a major finding by Bateman and Ross (2021). Participants in this study described working from home during the pandemic and struggling to help their school-aged children, as well as their tendency to work overtime being pushed to an extreme during the pandemic, both

findings that support Bateman and Ross. However, participants in the current study were able to maintain their positions throughout the pandemic, and some learned healthier habits from this experience and described setting boundaries and becoming more intentional with their family time, which are two findings that do not support Bateman and Ross's findings.

In regard to parenting, many participants perceived that having younger children could have a more negative impact on their careers. Several participants who had older children described being less successful had they had younger children, and one participant who was currently trying to have another baby described questioning how she would be able to continue her professional success. These findings of this study support the research of Hutt Cabello (2023), who identified a motherhood penalty where employers view pregnant women and women seen as "future childbearing risks" as less reliable, less capable, less promising, and less successful.

Thomas (2005) found that 28% of female participants reported putting their careers on hold to have children. Participant 7 in this study discussed actively trying to have a baby and shared her concerns over balancing that with the demands of her CTO position. However, no participants described feeling the need to put their careers on hold to have children, so the current study does not support that finding from Thomas. Further, this study does not support Thomas's finding that 47% of female participants perceived their employers provided fewer opportunities for advancement to women due to being unwilling to accommodate women's family responsibilities. Participants in this study described having more family responsibilities than male coworkers but did not report perceiving their districts as withholding advancement due to motherhood. In fact,

Participants 6 and 2 in the current study shared that the education field and their district were supportive places for mothers with young children.

Finding 7 in this study was that lack of representation was a common hindrance, and underrepresentation was viewed differently by women of color and White women. The current study's findings support the findings of Petersen (2014) and Dennehy and Dasgupta (2017), who found that female role models and mentors can bolster women's self-efficacy and belonging in the face of adversity. Participant 2 said, "It was very helpful to see women in those roles and to see them in person and hear what they were dealing with." Participant 4 described two female mentors who both "lead in a very strong and impactful way," and that she values how much they have helped her overcome challenges to become a better leader. Several participants described having mentors for so many years that the relationship has grown into a friendship. Participant 9 described mentors and colleagues "who have become like family and are very supportive in everything I do."

Women of color in the current study valued having a mentor who was also a woman of color, which supports the findings of Dreher and Cox (1996) and Blake-Beard et al. (2011). The U.S. House (1994) found that male STEM teachers who received equity education training showed subsequent improvement among female students. The participants in the current study expressed valuing diversity, equity, and inclusion in their own leadership, and all participants expressed positive experiences with anyone they perceived as an ally or advocate, so this finding supports those of the U.S. House (1994).

Researchers have also found that women with male mentors earn higher salaries and higher-level positions than women with female mentors (Burke & McKeen, 1996;

Dreher & Cox, 1996; Ragins & Cotton, 1999). These findings suggest that supportive male leaders can improve performance and increase success in females, which is supported by the findings of the current study in which seven participants reported benefitting from male mentors and four benefitted from male sponsors. Burke and McKeen (1996) also found that women in male-dominated fields with female mentors "reported greater intention to quit." Participants in this study reported positive experiences with female mentors who supported their career aspirations, so this study does not support that finding from Burke and McKeen (1996).

Conclusions

This section provides conclusions drawn from this study regarding the supports and hindrances the participants experienced in their careers as CTOs. This section includes the implications for action and the recommendations for future research. This section will close with concluding remarks regarding the study.

Implications for Action

Data from CoSN (2023) shows a low percentage of females in CTO positions across the United States compared to males. Additionally, the number of female CTOs has decreased over the last decade despite increased DEI initiatives in K-12 education and professional organizations. The findings in this study summarize the experiences of female CTOs and identify supports and hindrances that have implications for reducing the gender disparity among CTOs.

Professional organizations for EdTech leaders can learn from the DEI work done by CoSN to provide a network that represents all CTOs and where those in underrepresented groups feel seen and valued. More work can be done to increase

opportunities for women of color to connect with racially matched mentors and to encourage and equip men to be effective mentors to women. CoSN members value CETL, but more work can be done to educate others about the CETL and dispel the perception of many district leaders responsible for hiring that CTOs need technical degrees or certifications. Professional organizations should establish a code of conduct for vendors to set the expectation that sexism and other forms of discrimination will not be tolerated by any exhibitor, salesperson, or business partner. Additionally, initiatives for improving relationships between CTOs and vendors can be developed to help both parties avoid pitfalls and navigate challenges they will inevitably encounter.

Aspiring female CTOs can surround themselves with people who support them, whether that is family, friends, or colleagues. Joining CoSN and pursuing the CETL would also be a professional benefit. Due to the misconception that CTOs need technical degrees or certifications, it could benefit aspiring CTOs who have education, business, or other backgrounds to expand their technical training. Participants in this study mentioned the Cisco Certified Network Associate, Project Management Professional, and Information Technology Infrastructure Library certifications, as well as other less-intensive, budget-friendly certifications offered by vendors like Google and Apple. Teachers who aspire to become CTOs can benefit from expanding their education leadership skills to earn building and district-level leadership certificates or degrees, and aspiring CTOs without an education background can also complete an education leadership program to help them understand and succeed in the education field.

Aspiring CTOs will need to be motivated and work hard to achieve and succeed as CTOs, but establishing healthy habits around work-life balance could benefit their

career longevity. Aspiring CTOs with young children or who are still growing their families should not be discouraged by a motherhood penalty because many women before them have succeeded as CTOs and mothers. Female CTOs are inevitably going to face internal and external challenges, from self-doubt to sexism, so developing a growth-mindset and healthy ways to process and overcome negative experiences would be a major benefit both personally and professionally.

Current female CTOs should know they are not alone in their challenges. CoSN is an impactful network to find colleagues who will celebrate victories alongside them, help them problem-solve complex issues, challenge them to grow, and provide a powerful sense of belonging. Female CTOs who feel unsupported, misunderstood, or isolated should look outside their districts to find support in their state CoSN chapter and other professional organizations for EdTech leaders or women in technology. Female CTOs can benefit from having male and female mentors, so they should approach other leaders they respect and with whom they feel supported to propose a mutually beneficial mentorship. They should also be transparent with potential male mentors to set clear expectations and boundaries to avoid potential pitfalls with cross-gender mentoring.

Because female CTOs tend to be lifelong learners who value self-improvement, they will benefit from becoming comfortable with being vulnerable and understanding that vulnerability is not a weakness. Female CTOs can benefit personally and professionally from developing a growth mindset to see hindrances as temporary problems they have the resilience and tenacity to overcome. They will also benefit from developing self-awareness to understand how their behaviors align with their values and standards. They could explore assessment tools like CliftonStrengths (formerly

StrengthsFinder) and learn about using their unique strengths to their advantage to impact their career and life.

Female CTOs will benefit from establishing a healthy work-life balance while modeling and respecting those boundaries with their staff. Female CTOs who are married can benefit from developing partnerships with their spouse to share household responsibilities. CTOs who are mothers can avoid feelings of mom guilt by avoiding unrealistic expectations, observing boundaries for family time, and being present with their children. CTOs who are single mothers or become single parents should lean on their support system when needed, pursue opportunities in districts that value family and respect working mothers, and never forget the hard work and resilience that has helped them succeed thus far. CTOs who want to grow their families should not be discouraged by their career demands but should set realistic expectations for themselves and their support system.

Female CTOs should embrace every opportunity to learn and grow, whether that is taking online courses to enhance their technical knowledge or participating in DEI trainings. They can reflect on their own implicit biases and work to keep those in check by approaching experiences with empathy and positive intent. Female CTOs should work to support other women and EdTech professionals who are underrepresented or marginalized. They can use their position to develop inclusive technology departments that welcome and value diverse people, perspectives, and skillsets. That diversity could demonstrate to district leaders the benefits of developing district-wide practices for recruiting, hiring, and retaining talented staff from all walks of life. Female CTOs should

set specific, measurable, achievable, relevant, and time-bound (SMART) goals, model this practice for their staff, and ask mentors and colleagues to hold them accountable.

Superintendents can include CTOs in their cabinet or district leadership teams to decrease technology department silos and increase collaboration for successful technology implementation. Superintendents can support CTOs by valuing them as well-rounded professionals and respecting their thoughtful contributions to all leadership conversations, not just those that include technical aspects. Superintendents can become members of CoSN to benefit from the professional resources they offer for district administrators and gain a better understanding of the CTO role and the legal and ethical responsibilities therein. Superintendents can support the professional development and continued growth of CTOs by supporting participation and leadership in professional organizations and providing professional development budgets for CTOs so they can attend and present at conferences and offer their technology staff the same opportunities.

District leaders, including superintendents, human resource directors, and school board members, can work together to promote equitable recruiting and hiring practices that benefit all staff. District leaders can improve retention and increase job satisfaction among all staff by adopting practices and policies that value diverse skillsets and backgrounds and creating a workplace people love because they feel high levels of respect and belonging. District leaders should fully support these practices and model the kind of leadership where underrepresented or marginalized individuals thrive. For CTOs specifically, these district leaders can learn about the value of the CETL and understand how successful CTOs need expertise in educational, technical, and leadership areas equally. District leaders can support CTOs from different professional backgrounds by

expanding their skillsets, whether that is paying for technical training for a CTO with an education background or encouraging a CTO with a non-educational background to pursue an educational leadership program or making sure their perspective is welcomed in educational conversations.

Male CTOs can apply many of the implications for female CTOs to their own practices. Male CTOs can identify the implicit biases they have and work to create technology departments that are inclusive and supportive of all staff. They can recognize the importance of being an ally by practicing how to identify bias and getting comfortable interrupting it when it occurs. When dealing with gender bias, Male CTOs can stop men on their team who talk over or interrupt women in meetings, make sure women are included in decision-making and interview panels, take a genuine interest in hearing the expertise women have to offer, help their teams see how valuable women are by giving them opportunities to shine, and demonstrate how successful a team can be when it values and respects diverse perspectives and people. Male CTOs can learn how to be effective mentors for women in their departments and female aspiring CTOs. Male CTOs should understand the impact of sponsorship by taking time to recognize and acknowledge the successes of women and use their status to promote these women for leadership opportunities. Male CTOs can be advocates by helping their male colleagues to develop equitable and inclusive practices. Male CTOs can continue this work when they leave the office by partnering with their spouse, empowering their daughters, and modeling these beliefs and behaviors for their sons.

Recommendations for Future Research

The purpose of this study was to identify the external and internal supports and hindrances female CTOs in K-12 education experienced in their careers. The research question differentiated between while participants were pursuing a CTO position compared to while they were fulfilling the responsibilities of a CTO position. None of the participants set out to become a CTO, and most of the participants had been in a CTO position for five years or more, so participants struggled to identify supports or hindrances they experienced prior to becoming a CTO that were different from their experiences as CTO. As a result, future research focused on the experiences of women pursuing a CTO position could be conducted with participants who are aspiring CTOs or in their first years of a CTO position.

This study used both purposive and snowball sampling, beginning with members of the CoSN DEI subcommittee. All participants were members of CoSN and discussed how CoSN has been the most impactful professional organization in their CTO careers, citing networking with CTOs nationwide, CETL preparation courses and certification, and professional resources like white papers and model policies as some of the most valuable resources CoSN offers. A recommendation for future research is to identify female CTOs who are not currently CoSN members and investigate how their experiences compare to female CTOs who are CoSN members. Additionally, future research could be completed to gather qualitative data on how male CoSN members interact with professional resources and compare those findings to how female CTOs reported benefitting from CoSN research.

Sexism and gender bias were the most impactful hindrances experienced by participants, and several participants also experienced racism and heterosexism. Future research could be conducted with superintendents and human resources directors to investigate staff trainings or policies that confront discrimination in school districts. Data could then be collected from school district staff and other stakeholders like parents and students rating their perception of the effectiveness of the trainings and policies reported by district leaders to create district-by-district case studies that explore the most effective and ineffective policies and practices that confront discrimination.

Regarding sexism and gender bias, future research could be conducted to further explore the impact on female CTOs and experiences in which women have felt successful or unsuccessful in combatting different forms of gender discrimination. Because men were the primary actors in female's sexist experiences, future research could explore how men perceive sexist words and actions and investigate how men react to sexist events they have acted in or witnessed. Additionally, future research could focus on male allyship for women in male-dominated workplaces. Female participants could identify their male ally, and a case study could be conducted focusing on the female colleague and male ally relationship. Additionally, future research could be conducted to explore how men can be better allies and the most effective strategies allies use when confronting sexism and gender-bias in their workplace.

Similarly, future research could be conducted to explore the impact of mentors on female CTOs. Case studies could be conducted with mentor-mentee partners to explore all aspects of an effective mentoring relationship. Future research could be conducted using participants who have had both male and female mentors to identify any

differences in mentoring styles or effectiveness based on mentor gender. Participants in this study who were women of color often described the benefit of having a female mentor of the same race or ethnicity, so future research could be conducted to explore how mentor gender and race/ethnicity impacts women of color. Additional research could also be conducted to explore the impact of sponsorship on female CTOs and other underrepresented groups.

Sexism and gender bias from vendors were perceived to be major hindrances to female CTOs. Future research could be conducted to explore vender relationships and research ways vendors can be more respectful and inclusive in their interactions with customers. Many participants in this study reported experiencing sexism and bias from vendors while interacting at conferences, so additional research could be conducted to explore how professional organizations vet vendors for their conferences and if professional organizations have a code of conduct or other expectations and guidelines for vendors while they are exhibiting at conferences.

Participants discussed various issues with unsupportive district leadership or policies. Because superintendents and school boards are so powerful in hiring, promoting, and supporting the success of female CTOs, future research focused on these district leaders could be beneficial. Data could be collected to examine CTO job descriptions and what executive leadership perceives as the most important qualifications and qualities of CTOs to reveal if gender bias exists in hiring practices.

Concluding Remarks

The results of this study provided additional insight into an area where little research currently existed in 2024: the lack of representation of women in K-12 CTO

positions. Identifying common supports and hindrances experienced by this study's participants contributes to the collective body of knowledge surrounding female CTOs and has implications for women in the private technology sector and other male-dominated fields. The findings from this study provide opportunities for future research and insight into how professional organizations and school districts can improve their practices to create inclusive and successful environments for all.

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Appendices

Appendix A. Expert Panel Solicitation Email

Dear colleague,

I am the Instructional Technology Manager for the Belton School District in Belton, Missouri, and a doctoral candidate at Baker University. My dissertation title is *The Experiences That Supported or Hindered Females in K-12 Educational Technology Leadership*. I am in the process of gathering feedback related to the interview questions I plan to ask selected female Chief Technology Officers (CTOs). As a leader in educational technology, your input will be extremely helpful in gaining a better idea of whether I have an appropriate collection of questions for my audience.

I would appreciate it if you could take a few minutes to read my questions and provide feedback on changes such as improvements, relevancy, succinctness, and any other areas you think I may need to address. I ask that you evaluate the interview questions in the following areas:

- Are the demographic questions thorough enough to gather information on race, years of experience, etc., but not too personal or complex?
- Are the interview questions understandable and not too complicated?
- Do the interview and corresponding probing questions address all areas that support or hinder female CTOs?
- Are the questions presented in the most logical order?
- Is the interview length appropriate? If not, what suggestions do you have to improve the interview length?

Please find attached the interview questions for your review. Your input is greatly appreciated. I am requesting a response time of two weeks.

Please contact me at ivy1nelson@gmail.com or (660) 232-1158, or my advisor, Dr. Susan Rogers, at susan.rogers@bakeru.edu or (785) 230-2801 if you have any questions or concerns.

Thank you for your time.

Appendix B. IRB Approval from Baker University

Baker University Institutional Review Board

October 17, 2023

Dear Ivy Nelson and Susan Rogers,

The Baker University IRB has reviewed your project application and approved this project under Expedited Status Review. As described, the project complies with all the requirements and policies established by the University for protection of human subjects in research. Unless renewed, approval lapses one year after approval date.

Please be aware of the following:

1. Any significant change in the research protocol as described should be reviewed by this Committee prior to altering the project.
2. Notify the IRB about any new investigators not named in original application.
3. When signed consent documents are required, the primary investigator must retain the signed consent documents of the research activity.
4. If this is a funded project, keep a copy of this approval letter with your proposal/grant file.
5. If the results of the research are used to prepare papers for publication or oral presentation at professional conferences, manuscripts or abstracts are requested for IRB as part of the project record.
6. If this project is not completed within a year, you must renew IRB approval.

If you have any questions, please contact me at skimball@bakeru.edu or 785.594.4563.

Sincerely,

Scott Kimball, PhD
Chair, Baker University IRB

Baker University IRB Committee
Jiji Osiobe, PhD
Tim Buzzell, PhD
Susan Rogers, PhD

Appendix C. Solicitation Email

Date

Dear Colleague,

My name is Autumn Ivy Nelson, and I am a doctoral candidate at Baker University. You are receiving this email as an invitation for your participation in a study I am conducting to complete my dissertation. The study relies on input and information from female chief technology officers (CTOs). CTOs are the primary technology leaders in a school district, but may have different titles including director of technology, chief information officer, or technology coordinator. I will gather information about the experiences that supported and hindered females while pursuing a CTO position and serving as a CTO.

Your participation in this study will involve one semi-structured interview, consisting of the questions attached to this email. The time estimated to complete the interview is approximately 30-60 minutes. I will conduct and record interviews using Zoom. Your interview will be recorded and transcribed using an audio recording software. To ensure the validity of your statements, I will send you the transcript post-interview and allow you an opportunity to make any additions or corrections to your responses. This transcription review, called member checking, could take an additional 30 minutes. Your participation is completely voluntary; your name will be kept confidential, and all responses will be anonymous. No participant can be identified in my reports or publications because each participant will be assigned a unique pseudonym. Additionally, you may opt out of any questions to which you are not comfortable responding or discontinue your participation at any time.

If you are interested in participating in this research study, please contact me by responding to this email. Should you have any questions about this request, please reach out, and I will be happy to assist you (see contact information below). You may also contact my major advisor, Dr. Susan Rogers, at srogers@bakeru.edu or (785) 230-2801. Your participation would be valued and appreciated. Thank you for considering.

Sincerely,

Autumn Ivy Nelson
Baker University Doctoral Student
Email: autumninelson@stu.bakeru.edu
Mobile: (660) 232-1158

Appendix D. Informed Consent Form

Informed Consent Form

Please read this consent form carefully before you decide to participate in this study. The researcher will answer any questions prior to you signing this form.

Research Study Title: Experiences That Supported or Hindered Female K-12 Educational Technology Leaders

Purpose of the Study: The purpose of this qualitative, phenomenological study is to explore the experiences of female K-12 EdTech leaders and discover what supported or hindered their pursuit or fulfillment of the responsibilities of a chief technology officer (CTO) position. Specific details about participants' internal and external supports and hindrances will help the researcher understand their experiences and how they impacted participants.

Potential Risks of Participating: No risks are anticipated.

Potential Benefits of Participating: This study's findings could benefit current and aspiring female CTOs, their male counterparts who can be allies and sponsors for women in EdTech, and district leaders who can adopt more equitable recruitment and retention strategies for building more diverse technology teams within their school districts. The findings of this research could also impact women working in technology outside of education and the young women and girls in school districts who may or may not see themselves represented in their school district's educational technology leadership.

Compensation: Participants will not be compensated.

Confidentiality: The interview will be recorded and transcribed. Participants' identities will be kept confidential, and each participant will be assigned a unique pseudonym. No personally identifiable information will be used.

Voluntary Participation: Participation in this study is completely voluntary. There is no penalty for not participating. Participants may also refuse to answer any of the interview questions they choose.

Right to Withdraw from the Study: Participants have the right to withdraw from the study at any time without consequence.

Whom to Contact with Questions about the Study: Autumn Ivy Nelson (autumninelson@stu.bakeru.edu or 660-232-1158) or Dr. Susan Rogers, Associate Professor, Baker University (srogers@bakeru.edu or 785-230-2801).

Agreement: I have read the consent procedures described above. I voluntarily agree to participate in the consent procedures and have received a copy of this description.

Participant: _____Date: _____

Appendix E. Interview Questions

1. Tell me about your professional background.
    a. If your background is in education, what certificates or licenses do you hold?
    b. If your background is not in education, what field and what certificates or licenses do you hold?
2. How many years have you served as CTO (or how many years did you serve as CTO before retiring)?
3. Why did you become a CTO?
4. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what external factors supported you?

    Potential probing questions:

    a. What education or certifications supported you?
    b. What training or professional development supported you?
    c. What professional organizations were you part of and how did they support you?
    d. A mentor is a colleague who has been in the organization longer and helps guide you. A Formal mentor is when you are assigned a mentor, and an informal mentor is someone you naturally gravitated to. What formal or informal mentoring supported you?
    e. Sponsorship is different than mentoring because a sponsor is a person higher up in the organization who champions your work, promotes you for challenging assignments, etc. What sponsorship supported you?
    f. Describe your mentor or sponsor and the impact they had on you.
    g. Of all the external supports you shared, what was the most impactful external support?

h. Of all the external supports you shared, were there certain external supports that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

i. What external support would have benefited you while you were pursuing a CTO position?

j. What external support would have benefited you while you were fulfilling the responsibilities of a CTO?

5. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what internal factors supported you?

   Potential probing questions:

   a. What personal passions or interests supported you?

   b. What personal skills and abilities supported you?

   c. What personal values supported you?

   d. Of all the internal supports you shared, what was the most impactful internal support?

   e. Of all the internal supports you shared, were there certain internal supports that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

   f. What internal support would have benefited you while you were pursuing a CTO position?

   g. What internal support would have benefited you while you were fulfilling the responsibilities of a CTO?

6. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what external factors hindered you?

   Potential probing questions:

   a. What barriers to resources like mentoring or networking have hindered you?
   b. What policies or practices within the organization have hindered you?
   c. What biases, stereotypes, or sexism have hindered you?
   d. Of all the external hindrances you shared, what was the most impactful external hindrance?
   e. Of all the external hindrances you shared, were there certain external hindrances that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

7. When you were pursuing a CTO position or fulfilling the responsibilities of a CTO, what internal factors hindered you?

   Potential probing questions:

   a. What personal attitudes or feelings have hindered you?
   b. What past experiences or negative perceptions have hindered you?
   c. What aspects of work-life balance have hindered you?
   d. Of all the internal hindrances you shared, what was the most impactful internal hindrance?
   e. Of all the internal hindrances you shared, were there certain internal hindrances that were specific to while you were pursuing a CTO position versus while you were serving as a CTO?

8. As a woman in EdTech leadership, how has being underrepresented or a minority impacted you while pursuing or fulfilling the responsibilities of a CTO position?
9. Is there anything else you can share to benefit this research?
10. Are there other female CTOs in K12 EdTech leadership you recommend for participation in this research? If so, please provide their contact information.