Empowering Girls to Have a Choice: Investigating How Social Cognitive Career Theory Can Inform Middle School Computer Science Curriculums

EMPOWERING GIRLS TO HAVE A CHOICE: INVESTIGATING HOW SOCIAL COGNITIVE CAREER THEORY CAN INFORM MIDDLE SCHOOL COMPUTER SCIENCE CURRICULUMS

A Dissertation Presented

By

RICARDO POZA

Submitted to the Graduate School of the
University of Massachusetts Amherst in partial fulfillment
of the requirements for the degree

DOCTOR OF PHILOSOPHY

SEPTEMBER 2025

College of Education

Department of Teacher Education & Curriculum Studies

Mathematics, Science, and Learning Technologies

EMPOWERING GIRLS TO HAVE A CHOICE: INVESTIGATING HOW SOCIAL COGNITIVE CAREER THEORY CAN INFORM MIDDLE SCHOOL COMPUTER SCIENCE CURRICULUMS

A Dissertation Presented

By

RICARDO POZA

Approved as to style and content by:

____

Martina Nieswandt, Chair

____

Ivón Arroyo, Member

____

W. Richards Adrion, Member

____

Shane Hammond, Associate Dean for Student Success
College of Education

DEDICATION

To my dad, who never stopped learning.

ACKNOWLEDGMENTS

I would like to express my deepest gratitude to my advisor and dissertation committee chair, Dr. Martina Nieswandt. Your guidance and remarkable patience throughout this long and often arduous journey were instrumental in helping me complete this dissertation. I am equally thankful to the other members of my committee, Dr. Rick Adrion and Dr. Ivón Arroyo, for their invaluable insights, encouragement, and support.

I wish to acknowledge Dr. Florence Sullivan, whose passion for education inspired me to pursue a doctoral degree. I truly wish you were here to see me cross the finish line.

I am also incredibly grateful to my work family at the Tan Chingfen Graduate School of Nursing at UMass Chan Medical School. Without the unwavering support of Dean Joan Vitello, I would not be writing this manuscript today. I am thankful to all my colleagues at the Graduate School of Nursing; their pep talks, research tips, and constant encouragement helped sustain me more than they know.

And lastly, but certainly not least, thank you to my family, my wife, Brett, our children Sam and Sophie, and all our furry roommates, for their patience, love, and support over these many long years. I could not have done this without you.

ABSTRACT

EMPOWERING GIRLS TO HAVE A CHOICE: INVESTIGATING HOW SOCIAL COGNITIVE CAREER THEORY CAN INFORM MIDDLE SCHOOL COMPUTER SCIENCE CURRICULUMS

SEPTEMBER 2025

RICARDO POZA

B.M., BERKLEE COLLEGE OF MUSIC,

M.ED., UNIVERSITY OF MASSACHUSETTS AMHERST

Ph.D., UNIVERSITY OF MASSACHUSETTS AMHERST

Directed by: Martina Nieswandt

As jobs in the computer and information technology occupations are projected to increase 11.5% between 2019 and 2029, it is imperative that we have a strong pool of candidates that is wholly representative of our population. The percentage of women in computer science occupations continues to be substantially less than for men, representing almost 1 in every 4 (24% as of 2023) employed in the field; it is therefore crucial to identify solutions that could inspire more girls to pursue careers in computer science. Increasing the number of women in computer science is not only equitable and a just action to take that fosters socioeconomic mobility but also ensures the U.S.A.'s economic competitiveness through diversifying perspectives and increasing creativity and innovation.

Middle school has been associated with critical developmental milestones that guide identity formation and potential career choices. Using a descriptive mixed methods

approach, this study investigates how and if middle school CS curricula foster participation and engagement of girls in computer science. Social Cognitive Career Theory (SCCT), which is based on a triadic relationship between self-efficacy, goals, and outcome expectations, provides the foundation for identifying what components of CS curricula promote self-efficacy, career goals, and outcome expectations toward CS.

TABLE OF CONTENTS

Page

LIST OF TABLES

Page

LIST OF FIGURES

Page

CHAPTER 1

INTRODUCTION

1.1 Background

With a background in Computer Science people are trained for many different jobs such as information security analysts, computer systems analysts, computer and information research scientists, computer network support specialists, computer user support specialists, database architects, database administrators, computer network architects, network and computer systems administrators, web developers, web and digital interface designers, computer programmers, software quality assurance analysts and testers, or software developers (BLS, 2024). Of the 5,177,400 jobs in CS occupations in 2021, women accounted for only 24% of the total number of individuals employed (DOL, 2024), even though they represent 47% of the total workforce (BLS, 2025). Based on these numbers it seems that CS occupations are favored by men.

The paths for how individuals find employment in different fields are not necessarily linear (e.g., a degree that leads to a job), nor typically driven by a single factor (e.g., one early experience that leads to a lifelong pursue). Various theories such as Super's Developmental Self-Concept Theory (Super, 1980), Trait and Factor Theory (Parsons, 1909), Holland's Theory of Vocational Types (RIASEC) (Holland, 1959), Social Cognitive Career Theory (SCCT) (Lent et al., 1994) explain how individuals choose a career by focusing on biological, sociological, psychological, and cultural factors. For this study, I have chosen Social Cognitive Career Theory (SCCT) (Lent et al., 2000) a social cognitive framework aimed at explaining and predicting career behavior

(Swanson & Fouad, 2014) as the foundation for identifying and qualifying curricular elements. SCCT stresses a triadic corresponding association between environmental, behavioral, and personal factors over which people can exercise control throughout their lives. While personal factors such as interests, skills and values (Pham et al., 2024) can influence a person's behavior, or vice versa, the environment, such as the economic and social system in which a person resides, can affect personal factors and/or behavior that lead to specific career choices and the range of perceived and objective possibilities (Swanson & Fouad, 2014).

1.2 Focus and Scope

Middle school, which corresponds in general with grades 5 through 8, has been associated with critical developmental milestones that guide identity formation and potential career choices. Middle school represents the beginning of the transition from childhood to adulthood during which children undergo major physical, neurobiological, and psychosocial changes (Savaglio & Alvarado, 2021). Paradoxically, various studies also showed that during middle school, student interest and participation in science and engineering decreases rapidly even when grades in those subjects remain high (Calabrese Barton et al., 2013; Hill et al., 2010).

Leveraging SCCT as a theoretical framework, and middle school as critical years for identity formation and career development, this study aims at assessing how CS curricula in middle school in Massachusetts (grades 6, 7 and 8) foster student engagement with CS courses and activities, support the development of CS competencies, and outline potential careers in the field. More specifically, the focus is on how the CS curriculum supports and fosters students' (both girls and boys) self-efficacy sources (mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states), and how these affect middle school students' career goals, and outcome expectations.

Curriculum, in general, is viewed as a comprehensive concept comprised of teaching and learning materials (e.g., textbook, handouts, in-class activities) and state standards as well as support structures such as career counselors and parents/guardians. The Massachusetts Computer Science Digital Literacy (CSDL) standards include the following courses: computing and society, digital tools collaboration, computing systems, and computational thinking among many others (https://www.doe.mass.edu/stem/dlcs/g6-8-suggested-standards.xlsx).

1.3 Purpose of Research

The purpose of this descriptive mixed method study is to ascertain if, and to what extent, middle school Computer Science (CS) curricula include elements that may promote interest and motivation among students to engage and persist in CS courses and activities and potentially pursue careers in the field.

1.4 Research Questions

To answer the following research questions, I am employing a mixed methods research design, specifically utilizing a convergent parallel design (Creswell and Clark, 2011).

RQ1. How does a middle school CS curriculum and ancillary services promote sources of self-efficacy for girls?

a) Which elements of the CS curriculum foster enactive mastery experiences?

b) How do elements of the CS curriculum promote positive vicarious experiences?

c) What type of CS curriculum elements and support services (e.g., teachers, counselors, family, peers) exist and how do they offer verbal persuasion toward CS?

d) What type of CS curriculum elements and support services do middle schools provide to aid female students' physiological and affective states toward CS and how do they foster participation in CS?

RQ2. Do elements of the CS curriculum that promote sources of self-efficacy align with students' perceived self-efficacy, articulated career goals and outcome expectations?

1.5 Relevance of Research

With its focus on middle schools, this study enhances the body of research investigating how girls are being motivated, or discouraged, to pursue careers in computer science.

1.6 Dissertation Outline

In the following chapter, the Literature Review, I will examine the various career paths within the field of computer science and analyze the representation of women in this workforce. This chapter will also outline key career choice theories, with a particular focus on Social Cognitive Career Theory (SCCT), which is the chosen theoretical framework for this study. Additionally, the chapter will provide context by defining the study's working concept of curriculum, explaining how it will be operationalized to assess computer science curricular offerings, and why it is important to focus on middle schools.

The Methodology chapter will detail the structure of the study, including its research design, research questions, and data collection methods. This chapter will introduce all instruments used for data collection and explain the development of the SCCT evaluation rubric.

Chapter 4 will present the findings of the study, providing a comprehensive analysis of the results.

The final chapter, Discussion and Conclusion, will summarize the current state of secondary computer science (CS) education in Massachusetts middle schools. Additionally, this chapter will evaluate whether career counseling occurs at the middle school level and to what extent. Finally, the study’s limitations will be discussed, along with recommendations for future research areas.

CHAPTER 2

LITERATURE REVIEW

This chapter provides an overview of the various occupations within computer science (CS) and examines women's representation in those fields. It also explores key career development theories, the importance of career counseling for middle school students, and the rationale for selecting Social Cognitive Career Theory (SCCT) as the study's theoretical framework. Additionally, the chapter defines the concept of curriculum as used in this study and offers an overview of Massachusetts' K–12 CS standards.

2.1 Computer Science as a Career

Defining computer science (CS) as a career pathway is complex. The U.S. Bureau of Labor Statistics (BLS, 2023b), lists a broad range of roles under its "Computer and Mathematical Occupations" category, including information security analysts, computer systems analysts, computer and information research scientists, network support specialists, database architects, operations research analysts, statisticians, and data scientists. These roles represent a diverse set of required skills. For instance, the competencies needed by a database administrator differ significantly from those required of a statistician, computer programmer, or software quality assurance analyst. Yet, all of these professions are grouped under the broader umbrella of CS-related occupations.

Computer Science (CS), broadly defined, is "the study of computers and computing, including their theoretical and algorithmic foundations, hardware and software, and their uses for processing information" (Belford & Tucker, 2025). As technology becomes more integrated into our daily lives, especially in how we process and consume information, it is clear that computer science will continue to play a prominent role in the global economy (Hansen & Zerbino, 2022; Vegas et al., 2021). As this trend continues to evolve, those who have CS skills will be in high demand, enjoying many employment opportunities and flexibility affordances scarce in other professions. However, the number of people employed in these occupations, 5,177,400 (BLS, 2023a), remains relatively low compared to the growing demand. The U.S. Bureau of Labor Statistics projected overall employment opportunities in computer and information technology occupations to grow faster than the average for all occupations between 2023 and 2033 due to employment growth and the need to replace workers who leave these areas. (BLS, 2024).

CS skills are not only required in CS specific fields, but also for many other occupations. For example,” digital skills” that pertain to an individual’s ability to use digital tools in traditional work environments" include word processing, database management, social media and content management, video conferencing, and others (Ezell, 2021) are essential qualifications for many professions such as project management, communication, or marketing. While in 2002 about 44% of jobs required a medium-high digital skill level, this number had risen to 70% (Muro et al., 2017) and to 92% in 2023 across all industries (Bergson-Shilcock et al., 2023).

2.1.1 Women’s Representation in CS Workforce

In 2021, women made up only 24% of the 5,177,400 people employed in CS occupations (DOL, 2024) and out of every 4 employees – only 1 of those was a woman; despite representing 47% of the overall U.S. workforce (BLS, 2025).

Around the world, women's representation in the computer science (CS) workforce mirrors trends seen in the U.S. For example, in the United Kingdom, 29% of IT professionals are women in 2022/2023 (STEM STEM, 2023) and only 23% of IT technician roles in 2022/2023 (Office for National Statistics, 2025). In India, despite women comprising 50% of all STEM graduates, they accounted for just 34% of the IT workforce in 2018 (Ring, 2018). Across Europe, Estonia leads with the highest percentage of women in the ICT workforce at 29.1%, while other EU nations fall below this benchmark, e.g., German women represent only 19% of the total informatics and information and communications technology (ICT) workforce and Czechia reported the lowest participation at just 12.4% (EUROSTAT, 2024).

There are many reasons for the low number of women in computer science careers including societal stereotypes and lack of role models leading to lower interest and confidence in pursuing such a career.

As a potential strategy to increase motivation among girls, and subsequently women, to pursue careers in CS, this study leverages career development theories to identify curricular elements that may foster interest and participation in middle school CS courses and activities. These theories help explain how experiences shape beliefs over time, ultimately influencing decisions about future careers.

The following section explores key career development theories and what factors can shape individuals' career choices.

2.3 Career Development

A career by definition is "a profession for which one trains and which is undertaken as a permanent calling" (Merriam-Webster, n.d). But then, what is work or a job, and why should we all get one? According to Lent & Brown (2012), work takes on different roles, including 1) work as fulfillment; 2) work as an individual's public identity; 3) work as personal identity or self-construction; 4) work as normative expectation, group identity, and social contribution. Recognizing these roles provides a foundational understanding of what motivates individuals to work and, potentially, pursue a career. Colloquially referred to as a "job," work is often viewed as a normative expectation tied to group identity and social contribution, something people do primarily to earn a living.

Lent & Brown (2012), elaborate on the concept of why we work by connecting it to Maslow's (1943) hierarchy of needs. At its most basic (bottom of Maslow's Pyramid of Needs), individuals need to take care of their most urgent needs first, for basic survival (e.g., need for air, food, shelter, clothing), thus implying the need for work. Work generates an income, which then can be exchanged for goods and services. Then, as we move up Maslow's pyramid, and most basic needs are met, the role of work shifts. It becomes less about survival and more about self-actualization (i.e., work as personal identity or self-construction).

There are many different paths individuals take toward choosing a career, each shaped by personal experiences that influence decision-making. The University of California, Berkeley, Career Engagement Office defines career exploration as "the process of self-discovery that involves learning about one's interests, skills, and values, as well as gaining insight into various career options. It could also include identifying potential career paths and developing a strategic plan to achieve educational and professional goals" (UC Berkeley Career Engagement, n.d.). This process of self-discovery closely aligns with the framework described by Lent et al. (2000), in which individuals form interests, make career-related decisions, and experience varying levels of success in educational and professional pursuits.

Career development theories are aimed at investigating the mediating factors influencing an individual's motivation to pursue a particular career. These theories suggest that career choices are shaped by a range of influences, including biological (e.g., Super, 1980), sociological (e.g., Johnson & Mortimer, 2002), psychological (e.g., Lent et al., 1994), and cultural factors (e.g., Gottfredson, 1996).

For example, sociologists often examine career choice and development as the consequences of socioeconomic inequality and mobility, with occupation operating as a strong determinant of an individual's status within their community (Johnson & Mortimer, 2002). Given that individuals employed in computer and information technology positions earned an average of $113,140 per year in 2023 (BLS, 2023a), nearly 50% higher than the U.S. median household income of $80,610 (Census.gov, 2024), one would expect greater representation of women in the field according to this theory.

Another purpose of career development theories is to guide individuals in identifying potential career paths based on their traits, interests, and motivations. For example, career counselors often use Holland's (1959) theory of personality types to help students align their individual traits, categorized under the RIASEC model (Realistic, Investigative, Artistic, Social, Enterprising, Conventional), with compatible career paths.

Career development theories can also be used to guide retrospective analyses, such as examining the lived experiences of professionals to better understand the factors that influenced their initial interest in a field, their pursuit of education or training, and their eventual entry into the workforce. For instance, when examining individual pathways into the CS workforce, career development theories could be used to appraise whether factors such as educational experiences and support systems foster interest and motivation to pursue a career in the field.

The underrepresentation of girls, and subsequently women, in computer science is often described as a "leaky pipeline" (Blickenstaff, 2005), a metaphor highlighting the multiple points along educational and career pathways where girls and women may either engage with or disengage from CS. These "leaks" represent missed or lost opportunities that could have otherwise sparked interest or sustained participation in CS courses and activities over time.

By integrating Blickenstaff's "leaky pipeline" metaphor with career development theories, this study examines whether, and to what extent, middle school computer science (CS) curricula incorporate elements that can spark interest and sustain student engagement in CS courses and activities. Social Cognitive Career Theory (SCCT) will be used as the guiding framework for appraising curricula, with a focus on identifying the presence and strength of components that may foster interest in CS as a career path. The following section provides an overview of SCCT and its core components. A working definition of curriculum, as used in this study, will also be introduced later in the chapter.

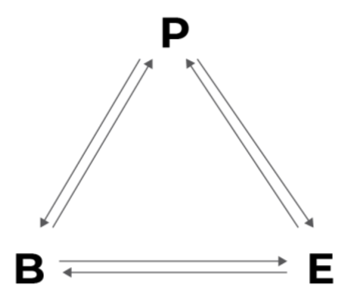
2.4 Social Cognitive Career Theory (SCCT)

SCCT uses various concepts and their interactions such as interest, abilities and values as well as environmental factors to explain three interrelated aspects of career development: "1) how basic academic and career interest develop; 2) how educational and career choices are made; and 3) how academic and career success is obtained (Greenhaus & Callanan, 2006, p. 750). Lent et al., (2002), describes SCCT as way to "trace some of the complex connections between persons and their career-related contexts, between cognitive and interpersonal factors, and between self-directed and externally imposed influences" (p.256).

SCCT is based on Social Cognitive Theory (SCT) as it provides a framework to understand the ways in which individuals form career paths as well as pursue and persist in academic endeavors. SCT assumes that individuals can exercise control over their lives (Bandura, 1997), operating in a triadic corresponding association between a person's behavior (B), external environmental factors (E), and personal factors (P) that include internal cognitive and affective states and physical attributes (Bandura, 1986). Figure 1 shows this triadic relationship "as interlocking mechanism that affect one another bidirectionally (Bandura, 1986; Lent et al., 1994, p.82).

Figure 1

Triadic Reciprocal Causation. Bandura (1997, p.6) Bandura (1986)



Note: B represents behavior; P the internal factors in the form of cognitive, affective, and biological events; and E the external environment

Building on Social Cognitive Theory, SCCT considers three closely linked variables: self-efficacy beliefs, outcome expectations, and goals. As an added layer, SCCT also considers how ethnicity, culture, gender, socio-economic status, social support, and career trajectories interplay with the decision-making process during career development (Blanco, 2011; Lent et al., 2000).

2.4.1 Self Efficacy

Self-efficacy explains how people feel, think, motivate themselves and behave toward tasks or skills (Bandura, 1993). In general, self-efficacy can be described as an individual's perceived competence toward a task. If an individual believes they can succeed at a particular task such as developing code that allows a robot to move on a flat surface, self-efficacy indicates that the likelihood of that individual engaging and persisting in that task increases.

Building on his earlier work, Bandura (1997) explains that self-efficacy beliefs are formed from the following four sources, including enactive mastery experience (past performance), vicarious experience (the experiences of others), verbal persuasion, and physiological and affective states (emotional response to one's perceived sense of efficacy).

2.4.2 Outcome Expectations

Outcome expectations, the second variable of SCCT, refers to the anticipated consequences (positive or negative) after initially engaging in a behavior (Bandura, 1997). Bandura clearly differentiates self-efficacy and outcome expectations: "Perceived self-efficacy is a judgement of one's ability to organize and execute given types of performances, whereas an outcome expectation is a judgment of the likely consequence such performances will produce" (Bandura, 1997, p.21). For example, a middle school student may anticipate the possibility of becoming a well-paid game designer after taking CS courses by connecting concepts and skills of a game designer to CS education.

2.4.3 Goals

The third variable of SCCT, goals, can generally be described as one's intention to engage in a particular task/activity or to achieve a specific level of performance (Greenhaus & Callanan, 2006). Examples can include "I want to become a computer scientist" or "I'm going to earn my bachelor’s in computer science, with honors".

2.4.3 SCCT in Predicting Participation in CS & STEM

Several studies suggest that SCCT can be utilized to predict and explain why individuals choose science and mathematics as their majors in college. In a study involving undergraduates enrolled in introductory psychology courses, Hackett (1985) demonstrated that mathematics-related self-efficacy expectations significantly influenced women’s pursuit of math-related careers. In another study, Schaefers and colleagues (1997) examined how self-efficacy and related variables predicted persistence among undergraduate women pursuing engineering majors. Nauta and Epperson (2003), conducted a four-year longitudinal study, following students from high school through college, to test a modified version of SCCT. Their findings validated Lent et al.’s (1994) model by demonstrating that self-efficacy and outcome expectations significantly influence interests and career goal choices.

The number of studies addressing career development in CS and what informs this decision-making process using a SCCT framework remain scarce. However, more studies were done in “adjacent disciplines” such as Science, Technology, Engineering, and Math (STEM) with focus on students from middle school (Kahn & Ginther, 2017).

The following section will examine career development opportunities available in K–12 education and explore the potential benefits of initiating these efforts in middle school rather than high school.

2.5 Career Development in K-12

Choosing a career is an important issue throughout children's development (Akosah-Twumasi et al., 2018), and is "reported to be associated with positive as well as harmful psychological, physical and socio-economic inequalities that persist well beyond the youthful age into an individual's adult life" (Akosah-Twumasi et al., 2018, p.1; Bubić & Ivanišević, 2016; Robertson, 2014). As children grow up, their career choices change and evolve as developmental changes and environmental circumstances affect their thinking processes (Akosah-Twumasi et al., 2018; Howard & Walsh, 2011).

Studies have indicated that middle school is an appropriate time for students to begin exploring future careers (Calabrese Barton et al., 2013; Glessner et al., 2017; Hill et al., 2010; Savaglio & Alvarado, 2021). Middle school represents the beginning of the transition from childhood to adulthood during which children undergo major physical, neurobiological, and psychosocial changes (Savaglio & Alvarado, 2021). Various studies also showed that during middle school student interest and participation in science and engineering decreases rapidly even when grades in those subjects remain high (Calabrese Barton et al., 2013; Hill et al., 2010).

Several interventional studies addressed this decrease, focusing on self-efficacy and motivation to participate in STEM disciplines in middle and high school (Alhaddab & Alnatheer, 2015; Ben-Zeev et al., 2005; Blascovich et al., 2001; Charleston & Leon, 2016; Cheryan et al., 2017; Master et al., 2017; McCartney et al., 2017; Smith et al., 2007; Vegas & Fowler, 2020). Alhaddab & Alnatheer (2015) found that high school girls' high self-efficacy represents a statistically significant likelihood of pursing undergraduate majors in STEM careers.

Charleston and Leon (2016) conducted retrospective interviews with African American graduate students and faculty in CS and STEM disciplines to explore how sources of self-efficacy influence persistence and engagement. Their findings highlight the importance of sustained exposure to behaviors that foster the development and reinforcement of efficacy beliefs, which are essential for maintaining long-term engagement and persistence. Cheryan et al., (2017) examined participation disparities between fields such as computer science, engineering, and physics, compared to biology, chemistry, and mathematics across different countries. They identified a lack of early exposure to CS, engineering, and physics as a key factor contributing to lower participation in these fields. Additionally, the authors argue that these disciplines often foster a 'masculine culture' that conveys a greater sense of belonging for men than for women, further widening the gender gap.

Vegas & Fowler (2020) and McCartney et al., (2017) found that faculty development and parent education were successful in offering a counter argument to popular beliefs (folk pedagogies) about who belongs in CS careers, thus boosting students' self-efficacy in CS. Other researchers have found that high school students mentored by college students can help mitigate the physiological effects of stereotype threat during high-stakes exams. (Ben-Zeev et al., 2005; Blascovich et al., 2001; Smith et al., 2007).

Middle school is a period of significant physical, neurological, and psychosocial development for girls, a time when they begin to shape their sense of identity and future aspirations. Given the importance of this developmental stage, it is crucial to identify and evaluate experiences that may influence their career decision making, particularly if we aim to increase their participation in computer science fields.

2.6 Career Counseling in Middle School

According to the American School Counselor Association (ASCA), “school counselors are certified/licensed educators who improve student success for ALL students by implementing a comprehensive school counseling program” (ASCA, 2023, p. 1). ASCA’s student standards identify three overarching domains, including academic development, career development, and social/emotional development; all applicable across all grade levels (ASCA, 2021). The career development domain emphasizes two key goals: 1) understanding the connection between school and the world of work; and 2) planning for and making a successful transition from school to postsecondary education and/or the world of work and from job to job across the lifespan (ASCA, 2021, p. 3).

Students typically begin developing career awareness in elementary school, exploring potential career options during middle school, and engaging in career planning and preparation in high school (Sanders et al., 2017). However, the amount of time spent by school counselors on career counseling at the middle school level is very limited. According to a study published in 2017 by Sanders and colleagues, middle school counselors in Virginia spent only an average of 12.15% of their total time in career counseling tasks/activities. Career counselors often face barriers to implementing career counseling effectively due to “competing demands, negative perceptions about career counseling, and low school counselor self-efficacy” (Sanders et al., 2017, p. 239).

Within the SCCT framework, career counseling could play a critical role in supporting students’ self-efficacy, outcome expectations, and goals. For example, school counselors can help students manage negative emotions associated with participating in courses or activities where they may feel they do not belong (i.e., physiological and affective states). They can also facilitate sessions to encourage students to begin thinking about career goals and possible outcomes. Counselors may support SCCT principles either directly, through student interaction, or indirectly by assisting teachers in incorporating SCCT-informed practices into instruction.

Given ASCA’s (2023) recommended caseload of 250 students per counselor, it is essential to evaluate the actual level of interaction between counselors and students with regard to career counseling. This study aims to assess both the frequency and depth of career counseling implementation in middle schools across Massachusetts.

2.7 Computer Science in K-12 Education

Although computers have been present in K–12 education for over five decades (Kausar et al., 2008), teaching computer science as a formal school subject is a relatively recent development, a phenomenon of the late 20th century. In 2006, Jeannette Wing introduced the concept of “computational thinking” to connect core principles of computer science with broader problem-solving approaches. In her seminal article in *Communications of the ACM*, Wing (2006) asserted that “Computational thinking is a fundamental skill for everyone, not just for computer scientists” (p. 1).

In 2011, the International Society for Technology in Education (ISTE) and the Computer Science Teachers Association (CSTA) outlined the following working definition of computational thinking as a problem-solving process that includes:

- Formulating problems in a way that enables us to use a computer and other tools to help solve them
- Logically organizing and analyzing data
- Representing data through abstractions, such as models and simulations
- Automating solutions through algorithmic thinking (a series of ordered steps)
- Identifying, analyzing, and implementing possible solutions with the goal of achieving the most efficient and effective combination of steps and resources
- Generalizing and transferring this problem-solving process to a wide variety of problems.

According to a report by Vegas and Fowler (2020) CS education continues to grow as several education systems acknowledge its importance. In their report, they state that out of 219 countries, 44 (about 20%) mandate that schools offer CS education as an elective or required course. These initiatives are also relatively new, and the authors mention that some of the countries offering CS education have not done it long enough, which limits efforts to accurately assess the effectiveness of instruction and curricular offerings.

Despite the known benefits that CS education offers students, including 21st century skills and a broader job outlook, CS education in K-12 education is not yet widespread across the United States. According to a report by CODE.org Advocacy Coalition, the Computer Science Teachers Association (CSTA) and the Expanding

Computing Education Pathways Alliance (ECEP) titled State of Computer Science (2024), 60% of high schools in the U.S. offered a foundational computer science course, but only 6.4% of high school students are enrolled annually. The report also states that as of 2024, 44 states now possess computer science standards.

When reviewing CS education policies in other countries, the U.S. shares similar approaches to integrating computer science into K–12 education. For instance, in the United Kingdom, computer science became a compulsory subject in both primary and secondary education starting in 2014 (Royal Society, 2017).

India has been offering computer studies as a subject for the past two decades (Iyer, 2019), however, its focus has been on usage and skill-based content. In 2016, India started an education initiative called CSpathshala (https://cspathshala.org). The mission of this initiative was to introduce CS skills relevant to problem-solving within K–12 education in India. The initiative's website highlights its success despite the complexity of the Indian educational system, which includes 1.6 million schools and approximately 300 million students. In addition, India has two national boards of education, and each state has its own education board.

Although, Germany has CS teacher education programs, there is no broad implementation of CS education as a proper subject in primary or secondary schools (Schroeder et al., 2018). According to DESTATIS (2024), the number of women taking CS courses in higher education is 260,078 or 22.47% of the total number of students taking those courses.

2.7.1 Computer Science Standards in Massachusetts

In 2016, the state of Massachusetts launched a state-wide Digital Literacy and Computer Science (DLCS) curriculum framework. Its standards are grouped into four strands: computing and society, digital tools and collaboration, computing systems, and computational thinking. The curriculum framework DLCS states that "digital literacy and computer science knowledge, reasoning, and skills are essential both to prepare students for personal and civic efficacy in the twenty-first century and to prepare and inspire a much larger and more diverse number of students to pursue the innovative and creative careers of the future".

In 2024 Code.org, CSTA, and the ECEP Alliance released the State of Computer Science Education Report that provided a clear state-by-state picture of each state's level of policy adoption, funding, teacher certification, and curriculum integration. It also included ten policy recommendations to strengthen CS education. These recommendations include: 1) create a statewide plan for K-12 CS; 2) define CS and establish standards for K-12 CS; 3) allocate funding for rigorous CS teacher professional learning; 4) implement clear certification pathways for CS teachers at elementary and secondary levels; 5) create programs at institutions of higher education to encourage all preservice teachers to gain exposure to CS; 6) establish dedicated computer science positions in a state education agency; 7) require that all schools offer CS with appropriate implementation timelines; 8) allow CS to count toward a core graduation requirement; 9) allow CS to satisfy an admission requirement at higher education institutions; and 10) require that all students take CS to earn a high school diploma.

Massachusetts received seven passing marks for policy recommendations 1,2,3,4,6, 8, and 9 and recommended improvement in two key areas: (7) expanding preservice offerings for teachers to ensure more educators are prepared to teach computer science; and (8) requiring CS courses as a high school graduation requirement, which would ensure all students gain exposure to computer science before completing their K-12 education.

2.8 Working Definition of Curriculum

This study aims to evaluate the presence and extent to which middle school computer science (CS) curricula promote the core elements of Social Cognitive Career Theory (SCCT): self-efficacy, outcome expectations, and goals.

To address the research questions, it is first necessary to establish a working definition of curriculum. Building on Kerr's (1968) definition of curriculum as "all the learning which is planned and guided by the school, whether it is carried on in groups or individually, inside or outside the school" (p.16), this study adopts Kerr's definition and proposes a few additional elements. In addition to planned and guided CS learning experiences, the intended and taught curriculum, this definition also includes extracurricular activities, support and feedback from school counselors, teachers, and administrators (e.g., CS enrollment guidance, mentoring during CS courses), as well as support from parents or guardians.

This comprehensive view of curriculum is intended to capture all factors that may influence student learning and motivation, as they can either encourage or discourage participation and persistence in CS-related courses and activities.

The following chapter outlines the study's methodology, providing detailed descriptions of each instrument, the SCCT rubric, and how they were used to address the research questions.

CHAPTER 3

METHODOLOGY

The purpose of this descriptive mixed method study was to ascertain if, and to what extent, middle school Computer Science (CS) curricula include elements that may promote interest and motivation among students to engage and persist in CS courses and activities and potentially pursue careers in the field.

The theoretical framework guiding this study was Social Cognitive Career Theory (SCCT), which posits that self-efficacy, goals, and outcome expectations form a triadic relationship that informs career decision-making.

When referring to curriculum, I am using the following definition: curriculum is the totality of experiences that facilitate student learning in a specific subject, in this case CS; including, but not limited to formal coursework, and both in-school and out-of-school support services that could influence students' motivation, physiological responses and affective states.

Using an SCCT rubric, the CS curriculum was systematically appraised to identify the presence and quality of each SCCT element (self-efficacy, outcome expectations, and goals) within the curriculum. The SCCT rubric is discussed in more detail in this chapter under section 3.6 SCCT Evaluation Rubric.

3.1 Research Questions

RQ1. How does a middle school CS curriculum and ancillary services promote sources of self-efficacy for girls?

a. Which elements of the CS curriculum foster enactive mastery experiences?

b. How do elements of the CS curriculum promote positive vicarious experiences?

c. What type of CS curriculum elements and support services (e.g., teachers, counselors, family, peers) exist and how do they offer verbal persuasion toward CS?

d. What type of CS curriculum elements and support services do middle schools provide to aid female students' physiological and affective states toward CS and how do they foster participation in CS?

RQ2. Do elements of the CS curriculum that promote sources of self-efficacy align with students perceived self-efficacy, articulated career goals and outcome expectations?

3.2 Research Design

This study was conducted in middle schools across Massachusetts with participation from students (n=23), their parents/guardians, teachers (n=8) and school counselors (n=1). To answer the research questions, I employed a convergent parallel mixed methods design (Creswell & Clark, 2011). Qualitative and quantitative data were collected through separate questionnaires for students, parents/guardians, school's staff, as well as through an appraisal of CS curricula; in some cases, data was analyzed concurrently and later triangulated.

Qualitative data was analyzed using the SCCT rubric, a rubric that was deductively and inductively created based on SCCT elements (3.6 SCCT Rubric). Quantitative data was analyzed using descriptive statistics to determine student's levels of motivation via the student questionnaire (CSMQ-II), and to determine parents'/guardians' tendencies (parent/guardian questionnaire).

The initial research protocol was approved by the University of Massachusetts Institutional Review Board (IRB), Federal Wide Assurance # 00003909 on May 24, 2024, under protocol ID 4973. An amended protocol was submitted and approved on February 27, 2025, because the original dataset included only one response from a CS teacher and none from school counselors or other staff. After the amendment, I was able to collect responses from an additional school counselor and eight teachers.

3.3 Participants and Recruitment

This study focused on appraising middle school CS curricular elements using an expansive definition of curriculum, data collection and analysis aimed to evaluate both the presence and extent to which the curriculum content, and the individuals involved in its delivery, assessment, and support, reflected elements of Social Cognitive Career Theory (SCCT). Participants in the study included students enrolled in CS courses, their parents or guardians, CS teachers, school counselors, and other school staff who provided support throughout the learning process.

Initial site recruitment began by identifying Massachusetts middle schools and districts currently offering CS courses. This search utilized the Massachusetts Department of Elementary and Secondary Education's (DESE) 2024 Digital Literacy and Computer Science Coursetaking Report (District) - All Students – ALL (DESE, 2024a). Since Massachusetts CS standards include digital literacy, the database was sorted by schools/districts offering computer science and digital literacy, and by grade levels.

After compiling a list of potential schools, I reached out to the leadership (superintendents, principals, curriculum directors) of 29 identified school/districts followed by contacting teachers (CS and STEM instructors) and school counselors. Additionally, recruitment calls were posted on the Massachusetts chapter of the Computer Science Teachers Association (CSTA) message boards.

Due to a lack of participating schools during the initial recruitment period, a second round of recruitment was conducted using email list servers such as the Massachusetts chapter of the Computer Science Teachers Association (CSTA), and the Massachusetts chapter of the American School Counselor Association (ASCA). I also reached out, via email, to CS teachers, STEM teachers, and support staff from schools that previously opted out of the study.

3.4 Data Collection

Data collection was initially designed to take place exclusively at participating middle schools. In other words, once a school opted to participate, participants (students, parents/guardians, and school staff) were to be contacted and offered consent forms. However, due to a lack of participating sites, the original IRB application was amended, and a secondary data collection protocol was implemented. The following sections will describe both the initial and secondary data collection plans.

3.4.1 Initial Data Collection (Fall 2023 to Fall 2024)

The initial data collection plan was to ascertain if, and how, middle school CS curricula contained elements of SCCT (self-efficacy, goals, and outcome expectations) directed toward CS. This initial data process had four objectives: objective 1) to assess students' motivation (CSMQ-II: intrinsic motivation, self-efficacy, self-determination, grade motivation, and career motivation) toward CS; objective 2) to learn about the parents'/guardians' occupational backgrounds and perspectives toward their child's occupational future; objective 3) to learn about the school's career and counseling initiatives, and curricular support systems for students taking CS courses; and objective 4) to appraise the CS curriculum by identifying the presence, and extent, of curricular elements that support SCCT components.

The following instruments/forms were implemented:

1. Parents/Guardians:
    a. Consent form
    b. Parent/Guardian Questionnaire
2. Students:
    a. Assent form
    b. Student Questionnaire, including Career Motivation and Computer Science Motivation Questionnaire (CSMQ-II)
    c. Participation in presentation/discussion titled "Choosing a Career" (see Appendix K)
3. Support Staff (school counselors and other student support staff) and leadership
    a. Staff Questionnaire
4. CS curriculum (meeting with CS instructor)

Participation for the initial data collection was limited to those students (and their parents/guardians) in middle school taking computer science courses, as well as support staff (counselors, teachers) within the school.

3.4.2 Secondary Data Collection (Spring 2025)

The sole aim of the secondary data collection protocol was to complete a comprehensive dataset that included responses from students, parents/guardians, and school staff. After the initial round of data collection, only one CS teacher had participated, and no school counselors were represented. To address this, the original IRB application was amended to include revisions to both the staff consent form and the questionnaire.

The revised staff questionnaire's objective was to elucidate information about middle school CS curricula, including recruitment and enrollment practices, curricular elements (such as units and assessments), and if career counseling initiatives took place and to what extent. A more detailed account of the changes from the original staff questionnaire to the revised version will be presented later in this chapter when discussing the instrument (revised staff questionnaire).

3.5 Instruments

The following section provides detailed descriptions of each of the instruments, including their development, content, and administration processes.

Let us now focus on each of the instruments used in this study, including questionnaires (Appendices A, B, C, and D) and the consent (Appendices F, G, and H) and assent form (Appendix E). The following sections will provide detailed descriptions for each of the instruments, including its development, content, and administration process.

Table 1 presents the instruments used to address the research questions and sub-questions.

Table 1

Research Questions and Instruments

Research Question	Instrument
RQ1 How does a middle school CS curriculum and ancillary services promote sources of self-efficacy for girls?	
a) Which elements of the CS curriculum foster enactive mastery experiences?	Curriculum Assessment, All Questionnaires
b) How do elements of the CS curriculum promote positive vicarious experiences?	Curriculum Assessment, All Questionnaires
c) What type of CS curriculum elements and support services (e.g., teachers, counselors, family, peers) exist and how do they offer verbal persuasion toward CS?	Parents/Guardian Questionnaire, Revised Staff Questionnaire
d) What type of CS curriculum elements and support services do middle schools provide to aid female students' physiological and affective states toward CS and how do they foster participation in CS?	Curriculum Assessment, Revised Staff Questionnaire
RQ2 Do elements of the CS curriculum that promote sources of self-efficacy align with students perceived self-efficacy, articulated career goals and outcome expectations?	Student Questionnaire, Curriculum Assessment

3.5.1 Parent/Guardian Questionnaire

The parent/guardian questionnaire was designed to provide insights into each child's home environment and support (RQ1c). It asked parents/guardians to share their race/ethnicity, level of education, profession (including that of spouses/partners and extended family), and their opinions about what profession they believe their child should pursue and why.

The questionnaire also included a series of questions on a four-point Likert scale (never, rarely, often, always) to capture parents'/guardian's perspectives and attitudes that could impact their child's self-efficacy, outcome expectations, goals toward career decision-making. Some example questions include: Salary is the most important thing when considering a job/career (outcome expectations); My child is going to follow in my footsteps (goals); Being good at a particular field/discipline is important when considering a job/career (self-efficacy); I wholeheartedly support my child's decision to embark on a career/field of study (verbal persuasion); My child is good with technology (self-efficacy). See Appendix B for a full listing of all questionnaire questions.

To align student and their parent/guardian responses a participant code was attached to each survey.

3.5.2 Student Questionnaire (CSMQ-II)

The student questionnaire was designed to assess students' motivation toward CS and to gather general information about their career goals (RQ2). To evaluate intrinsic motivation, self-efficacy, self-determination, grade motivation, and career motivation in relation to CS, a modified version of the Science Motivation Questionnaire II (SMQ-II) © 2011 Shawn M. Glynn (Glynn et al., 2011) was used. The SMQ-II section includes 25 items (see Appendix A), on four-point Likert scale (never, rarely, often, always), and five questions for each of the following subscales:

- Intrinsic Motivation: assesses the extent to which a student engages in a task out of personal interest, enjoyment, or curiosity (Deci & Ryan, 1985). E.g., "01. The science I learn is relevant to my life."

- Self-Efficacy: measures an individual's belief in their ability to successfully perform a specific task (Bandura, 1986). E.g., "09. I am confident I will do well on science tests."
- Self-Determination: relates to a student's sense of autonomy or volition in engaging with a task (Deci & Ryan, 1985). E.g., "05. I put enough effort into learning science."
- Grade Motivation: refers to the extent to which a desire to achieve high grades marks engagement with a task (Pintrich, 2000). E.g., "02. I like to do better than other students on science tests."
- Career Motivation: captures the belief that engaging with a task will support future career success (Eccles & Wigfield, 2002). E.g., "07. Learning science will help me get a good job."

Originally developed to assess student motivation toward science, the SMQ-II was adapted by replacing the term "science" with "computer science", similar to how the instrument has been adapted for other subjects, such as biology (BMQ-II), chemistry (CMQ-II), or physics (PMQ-II). In this study, the adapted instrument is referred to as the "CSMQ-II" to accurately reflect its focus on computer science.

According to (Glynn et al., 2011), the SMQ-II was assessed using the Flesch-Kincaid, indicating readability at the sixth-grade level; making it suitable for middle school students. A review of the literature indicates that this study is the first documented instance of the SMQ-II being used to assess middle school students' motivation to learn computer science (CSMQ-II).

In terms of reliability, Glynn et al., (2011) reported the following Cronbach's alpha scores for each section: career motivation (0.92), intrinsic motivation (0.89), self-determination (0.88), self-efficacy (0.83), and grade motivation (0.81). The combined reliability score for all 25 items was reported at 0.92.

The questionnaire also collected demographic information, including students' age, race, and gender. Additionally, students were asked to share their thoughts about potential future careers, their parents'/guardians' occupations, their parents'/guardians' expectations regarding their future careers, and whether they agreed with them. An open-ended section gave students the opportunity to add any further comments or insights.

3.5.3 Student's Focus Group/"Choosing a Career" Presentation

Student participants completed the questionnaire during an in-person visit to the school, which was coordinated through the CS teacher and held during regular CS class time. Students who opted not to participate in the study engaged in an alternate activity during this period. The time allotment for both completing the student questionnaire and conducting the focus group/presentation was one period (about 50 minutes).

Following the questionnaire, a focus group and presentation session titled *"Choosing a Career"* was conducted to gather additional insights from students about their career aspirations and perceptions of computer science as a potential career path. The presentation introduced students to the field of computer science, including typical responsibilities of computer scientists, salary expectations, and educational pathways. It also incorporated elements of Social Cognitive Career Theory (SCCT), specifically self-efficacy, outcome expectations, and goals, to help students reflect on potential career ideas and discuss their interests. See Appendix K for an outline of the focus group/presentation.

The focus group/presentation was audio recorded and transcribed.

3.5.4 Staff Questionnaire

The staff questionnaire (original and revised versions) include demographic questions such as gender, race/ethnicity, level of education, and role at the school. Additionally, it features a series of open-ended questions designed to assess whether the staff member, in their professional capacity, has facilitated experiences or opportunities for students to explore career choices as well as general questions regarding the staff member's perspectives on college counseling at the middle school level.

Due to low levels of school and district participation, an amended IRB application was submitted in January 2025 to obtain permission to launch a revised staff questionnaire. The primary goal of revising the staff questionnaire was to collect general information about middle school CS curricular offerings across Massachusetts. The revised questionnaire can now be completed by CS or STEM teachers, as well as school counselors or administrators, without requiring the entire school to formally participate in the study. Additionally, the staff consent form was updated to include a $5 Dunkin gift card incentive for participation.

The original staff questionnaire consisted of 15 questions, including demographic items. The revised version now contains 19 questions, with additional items aimed at allowing CS instructors to provide descriptions of their curriculums (e.g., "8. What type of CS curriculum does your school use? Is it a custom-developed curriculum, a third-party resource (such as Code.org), or a combination of both? Please describe"; "9. Can you describe the key topics/units covered in your CS curriculum?"; "10. Can you provide descriptions of the assignments included in your CS curriculum?"). Questions specifically related to CS curricula were only presented to respondents who identified themselves as CS instructors, others (such as school counselors, non-CS teachers, administrators, or other staff) automatically skipped these questions.

Questions about career counseling included: "11. How would you describe current career counseling initiatives at your school?"; "14. In your role, are there opportunities for you to positively influence curriculum in ways that promote conversations about career counseling? Yes, No, N/A. If Yes, please describe how:"; "17. What are your thoughts about college counseling at the middle school level?".

The questionnaire also included two questions related to gender representation in the workforce: "15. In your role, have you had opportunities to discuss with students traditionally gendered roles in career/jobs? (For example, 87% of registered nurses in the U.S. are women). Yes, No, N/A. If Yes, please tell us more"; "16. In your role, do you have opportunities to provide encouragement for girls to participate in traditionally male dominated courses/activities like computer science?". See Appendix D for the entire revised staff questionnaire.

3.5.5 Data Collection Schedule

Data collection schedule involved the following steps:

1. Each participating student was given a folder at school to take home and that contained the following items:
   a) Cover letter explaining the research plan, dates, etc.
   b) Student consent form

c) Parent/Guardian questionnaire

2. Staff/Leadership received a link to an electronic version of the staff questionnaire (Qualtrics).
3. Once a mutually agreed upon date was set between the CS Instructor/leadership and myself, I would schedule a visit to the school:
   a) Every student who had returned their consent form was invited to participate in an onsite session, and students who were not participating in the study were given an alternative activity. Once all participating students were gathered, they were asked to complete the student assent form.
   b) After the assent form was completed, students were asked to complete the student questionnaire (CSMQ-II).
   c) On the third, and last step, I lead a presentation titled "Choosing a Career". The presentation stressed different aspects of CS as a career, including salary, possible occupations, skill requirements, educational paths, etc. The presentation was interactive and structured in a quasi-focus group format. The entire presentation/discussion took about 30 minutes.
4. Review of CS curricular materials such as curriculum outline, lesson plans, activities, assignments, rubrics, etc. I was particularly interested in identifying alignments between the curriculum and elements of SCCT.

3.6 Curriculum Assessment

To assess the presence and quality of curricular elements that may promote components of SCCT (RQ1a, b, and d; RQ2), the CS curriculum was systematically evaluated using a mixed methods approach, incorporating both quantitative and qualitative analysis. The analysis methodology chosen for this study was content analysis (CA).

3.6.1 Content Analysis

Content analysis (CA) can be defined as "a research method that uses a set of procedures to make valid inferences from text" (Weber, 1990, p. 9). For this study, CA offers an ideal framework for systematically examining CS curricula, as it provides a methodology to assess both the presence (frequency) and the quality of specific curricular elements.

From a procedural standpoint, CA involves determining units of analysis, developing a coding scheme, analyzing the data, and interpreting the findings (Leavy, 2017). For this study, the units of analysis included open-ended questionnaire responses, and the written text, images, and multimedia elements in the curricular materials. The coding scheme incorporates both deductive and inductive approaches.

3.6.2 Coding

The impetus for this research is to assess how middle school CS curriculums have elements that could potentially foster interest and participation in CS courses and activities, similar to Career Technical Education (CTE), where students are exposed to career preparation and exposure to different fields while in high school through either regional technical or traditional/comprehensive high schools (2024b). Using a backwards design, or understanding by design, model (Wiggins & McTighe, 2005), starting with the end first, SCCT was leveraged to identify if curricular elements and experiences taking place during middle school could contribute to children's development of self-efficacy beliefs, goal setting, and positive outcome expectations toward CS.

Given that Social Cognitive Career Theory (SCCT) serves as the theoretical framework for this study, curricular analysis was guided by its core constructs: self-efficacy, outcome expectations, and goals. These elements were used to develop a rubric (SCCT rubric) to identify the presence and quality of curricular elements that support the development of self-efficacy, discuss outcome expectations, set personal goals, and provide culturally appropriate supports and services to encourage participation and engagement in CS courses and activities, as well as whether opportunities for reflection and constructive feedback were being offered and whether proposed career choices were influenced by societal expectations (e.g., gender stereotypes) and cultural norms and values.

The following six deductively derived top-level codes formed the foundation of the SCCT rubric:

1. Self-Efficacy Sources Development (SE-DE)
2. Outcome Expectations Alignment (OE-A)
3. Personal Goals and Career Identity Development (PG-CI)
4. Addressing Barriers and Equity in Career Access (AB-EQ)
5. Cultural and Contextual Relevance (CU-CR)
6. Feedback and Reflection Mechanisms (FE-RM

Subsequent sub-categories were used to address further subdivisions of the core elements of SCCT. An example of such deductive subcodes are the different sources of self-efficacy sources development: enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states.

3.7 Coding Rounds

To begin the analysis, I first immersed myself in the data, an essential step that, according to Leavy (2017), offers three key benefits helping researchers 1) "feel the pulse" of the data; 2) develop initial insights; and 3) begin the process of data reduction. After the secondary data collection phase was completed, I reviewed the full data set using the SCCT rubric. First, I applied the six top-level deductive categories above, assigning each code to every coding unit.

In the second round of analysis, descriptive coding was used to inductively generate additional subcategories from the data (Saldaña, 2021). This process revealed the need to expand the SCCT rubric to distinguish between elements embedded within the intended curriculum and those stemming from interactions with parents/guardians and school staff (i.e., curricular content versus direct interpersonal or community-based supports).

3.8 SCCT Evaluation Rubric

The following sections present each element of the SCCT rubric, along with the rationale for its inclusion and relevance to the study.

3.8.1 Self-Efficacy Sources Development (SE-DE)

The first rubric element is closely connected to each of Bandura's (1997) sources of self-efficacy (enactive mastery experience, vicarious experience, verbal persuasion, and physiological and affective states).

3.8.1.1 Enactive Mastery Experiences.

According to Bandura (1997), enactive mastery experiences are the most influential source of self-efficacy, as they provide authentic opportunities to demonstrate one's ability to successfully complete a task. For example, successful experiences strengthen a sense of personal efficacy, while failures can undermine confidence in one's capabilities. However, defining mastery experience as simply completing one task or overcoming one challenge is not sufficient. It cannot be distilled to the result of a single action, but as the ongoing result of "organized and controlled cognitive and other self-regulative subskills" honed over time to reach the level of achievement. Bandura (1997) states "complex performances are neither the products of an act of will nor simply the emission of implants of external rewarding and punishing experiences" (p. 80). Bandura (1997) outlines the acquirement of "cognitive, behavioral, and self-regulatory tools" as prerequisites to mastery.

From an evaluation point of view, I associate Bandura's set of prerequisites to mastery with competence as defined by Romiszowski (2009) described as the "the cluster of skills, abilities, habits, character traits, and knowledge a person must have in order to perform a specific job well" (p. 203). By breaking down the components of mastery, or competence, I use it as a framework to assess if, and how, curricula foster an environment that could lead to mastery.

The following essential components of curricula must be present to potentially provide mastery experiences:

<u>A clear evaluation criterion</u>. Curricula must possess assessment methods that allow students to understand when they are successful at tasks. Curricula should also include ample formative assessments, offering opportunities for improvement.

Example: assessment methods that clearly distinguish between different levels or accomplishments with examples of student's work and are easy to understand.

Content scaffolds. Content is sequenced to build from foundational to complex. Students develop competencies as they build skills and conceptual knowledge, content understanding and skills are often evaluated presenting gradual increases in challenge and evaluative feedback throughout.

“A resilient sense of efficacy requires experience in overcoming obstacles through perseverant effort” (Bandura, 1997, p.80).

“Development of the cognitive basis of human competencies is facilitated by breaking down complex skills into easily mastered subskills and organizing them hierarchically” (Bandura, 1997, p.80)

“Mastery… is a gradual accretion of knowledge, conceptual understanding, judgement, and skill” (Brown et al., 2014, p.18)

Example: Scaffolding of competences is outlined in developmental order; students can assess where their initial skill level is and where they will be once they have mastered the competence.

Opportunity for reflection. The curriculum includes elements that afford students opportunities to explore their learning.

Self-regulatory tools (Bandura, 1997)

Example: a written reflection that asks students to discuss what strategies have helped them figure things out, including questions related to how much effort was spent, what worked, what did not.

Elements that support children’s autonomy to exercise control: pedagogies that promote self-regulation are preferred. Children must be able to attribute success to their own skills, efforts, and strategies rather than to external factors.

Bandura (1997) argues that providing individuals with assurances that they are in control of their learning/achievement is more effective than repeated positive reinforcement.

Example: preference for project and/or problem-based instructional strategies that allow children to work on projects with a certain level of autonomy. Teachers can provide feedback and guidance as needed, but the onus on learning is placed on the individual.

<u>Educational units must lead to capstone projects/artifacts</u>. Learners must be afforded opportunities to learn the skills and knowledge necessary to complete a project or artifact.

"Most competencies must be developed over a long period" (Bandura, 1997, p. 86)

Example: students develop a robotic artifact that utilizes multiple sensors and servos to independently complete a series of tasks.

3.8.1.1.1 Learning Experiences and Skill Development.

Originally as its own category within the rubric, I realized during coding that learning experiences and skill development are indeed part of enactive mastery experiences.

Learning experiences play a pivotal role in shaping self-efficacy and outcome expectations (Bandura, 1986). In Lent and Brown's (2013) model of career self-management, these experiences are fundamental to building self-efficacy.

Leveraging Kolb's (2014) experiential learning model, a curriculum can effectively link skill development with real-world job applications. Kolb's model includes four key areas: concrete experience, reflective observation, abstract conceptualization, and active experimentation. Each area can guide the identification of essential curricular elements. For instance, 1) concrete experience: engage learners in real-world activities, such as internships or professional shadowing; 2) reflective observation: provide opportunities for learners to reflect on their experiences, identifying strengths and areas for improvement; 3) abstract conceptualization: help learners make connections between insights and actual practice, promoting deeper understanding; and 4) active experimentation: encourage the application of knowledge and skills through projects and real-world challenges.

Examples:

- Curriculum offers hands-on experiences that foster competency development, with an emphasis on practical content rather than theoretical (lectures).
- Curriculum includes CS skill development that could foster self-efficacy attainment and enhance outcome expectations.
- Curriculum leverages active learning strategies, including student led methodologies such as project and problem-based learning.

3.8.1.2 Vicarious Experiences.

According to Bandura (1997), individuals cannot use just their own measure of ability in isolation to assess efficacy, but must also see how their abilities are in reference to the abilities of others. These comparisons can also be heightened or diminished by performance superiority in relationship to group norms or conversely by low normative standing (1997).

The basis for these comparisons is based on affinity, including comparing ourselves to classmates, competitors, work colleagues, or those engaged in similar endeavors (1997, p. 87). Other comparisons can be based on being of similar social standing, age, race, gender, educational level, or ethnic designation (1997, p. 98). These comparisons can be both objective (e.g., established comparable attributes such as: race/ethnicity, gender, nationality) and subjective (e.g., we look about the same age, we must have a similar belief systems), and can be attributed to the person's perceived similarity or to external labeling mechanisms.

As women currently represent nearly a quarter of all computer science workers, the opportunity for any person to meet a woman computer scientist are limited. Compounding this fact is women's representation by race and ethnicity:16% White, 3% African American/Black, 7% Asian, and 2% Latina/Hispanic (Beldon et al., 2024). Women's dearth of representation in CS fields can have the unintended consequence of functioning as a confirming factor for girls that they may not belong in the field.

Examples:

- Curriculum includes content highlighting women role models in CS across races and ethnicities.
- Curriculum includes visits to colleges/universities to meet CS students.
- Curriculum facilitates interviews/discussions with CS professionals.
- Curriculum includes a CS mentoring program, including high school or college students, and/or CS professionals.

3.8.1.3 Verbal Persuasion.

According to Bandura (1997), persuasive efficacy information is typically shared when someone offers evaluative feedback to a performer (p.101). This performative feedback can include positive or negative evaluations about a specific action or demonstration. When positive feedback is given, it can strengthen people's beliefs about their capabilities, while it can also undermine someone's performance appraisal when it is negative.

Examples:

- Curriculum offers consistent, fair, and regular feedback that focuses on student's abilities, and is aimed at helping students grow.
- Participation in CS courses and activities is encouraged for all. Potentially, additional encouragement is offered for girls to participate.
- Curriculum engages with parents/guardians to encourage participation in CS courses and activities.
- Curriculum includes CS resources/activities for parents/guardians to do together with their child.

3.8.3.3.1 Environmental Supports and Resources.

Similarly to category Learning Experiences and Skill Development, Environmental Supports and Resources was originally its own category. However, during analysis it become apparent as the supports mentioned in this category felt under the general umbrella of verbal persuasion.

SCCT aims to understand how individuals develop interests, make choices, and achieve success in educational and occupational pursuits (Lent et al., 1994). As individuals progress from initially considering a career to actively participating in a field, various factors influence this trajectory. Drawing from Bandura's (1997) triadic reciprocal causation model (Figure 1), career choices are shaped by the interaction of internal factors (cognitive, affective, and biological events), behaviors, and the external environment.

The external environment can both support and hinder career development. While positive supports and scaffolds can encourage pursuit of a field, barriers can push individuals away from their potential interests. This rubric element focuses on evaluating the type and quality of environmental supports and resources available to students who may find participating in CS courses and activities challenging. Such supports might come from school counselors, teachers, parents/guardians, or older peers, including high school or college students.

Examples:

- Curriculum either explicitly, or by extension of school counselors, provides supports for students to explore careers in CS.
- Curriculum includes a CS mentoring program, including high school or college students, and/or CS professionals.

3.8.1.4 Physiological and Affective States.

The last source of self-efficacy according to Bandura (1997) relates to how people partly rely on somatic information as part of physiological and emotional states.

Examples:

- Curriculum provides outlets for self-expression via curricular activities (e.g., conversations/assignments to explore students' feelings and emotions, connections with socio-emotional learning content).

- Curriculum either explicitly, or by extension of school counselors, exhibits support to counteract issues of gender, culture, or ethnicity that may hinder participation in CS courses or activities (e.g., stereotype threat).
- Curriculum either explicitly, or by extension of school counselors, fosters an environment of inclusion and belonging for all.

3.8.2 Outcome Expectations Alignment (OE-A)

Outcome expectations represent the individual's imagined consequences after performing a specific behavior (Lent et al., 1994). Although, middle school students may have a harder time connecting how their participation in a CS course may lead to a career in the field, a curriculum can present a pathway that may lead to a career in computer science. Connecting competencies to be learned in class to real-world CS applications can help students visualize a career in the field.

Examples:

- Curriculum includes content about careers in CS including salary, educational paths, vocational opportunities, etc.
- Curriculum includes opportunities for students to engage with CS professionals.
- Curriculum includes projects/assignments that are grounded in real-world CS applications.

3.8.3 Personal Goals and Career Identity Development (PG-CI)

Goals, like the other two elements of SCCT (self-efficacy and outcome expectations), play a role in fostering interest and encouraging participation in career-related activities. They can become the aspirations and targets that individuals set for themselves in relation to personal achievements and future career paths.

According to Lent et al. (1994), career interests can evolve into goals, which may then translate into actions. This progression is influenced by an individual's perception of environmental factors, whether they see them as adverse or supportive (e.g., insurmountable barriers or inadequate support versus ample support and few obstacles) (p. 38). This mediating process is aligned with Bandura's (1997) triadic reciprocal causation model (Figure 1).

Setting goals acts like creating a roadmap, helping individuals evaluate what is needed, how to achieve it, and whether they are making progress toward their objectives. Similar to a project charter, goals help direct effort and persistence, organize actions, sustain motivation, and serve as a benchmark for evaluating progress.

Examples:

- Curriculum engages students in goal-setting activities.
- Curriculum includes career planning activities (e.g., future professional portfolio or career map)
- Curriculum explores career identity by showcasing professionals working in the field of CS.

3.8.4 Addressing Barriers and Equity in Career Access (AB-EQ)

SCCT has been widely used as a theoretical framework to investigate factors contributing to the underrepresentation of women and racial-ethnic minorities in STEM fields (Fouad & Santana, 2017). Given SCCT's focus on self-efficacy and outcome expectations, raising awareness of the barriers limiting women's representation in CS fields could help girls develop adaptive career behaviors (Lent & Brown, 2013), providing them with strategies for coping and addressing challenges in the future.

Examples:

- Curriculum includes content about CS field participation challenges (e.g., gender equity, discrimination, barriers to participation, belonging, etc.).
- Curriculum highlights contributions to the field of CS from diverse individuals (e.g., innovators, game designers, entrepreneurs, etc.).

3.8.5 Cultural and Contextual Relevance (CU-CR)

Bandura (2006) argues "…human functioning is a product of a reciprocal interplay of intrapersonal, behavioral, and environmental determinants. . ." (p. 165). When making career decisions, individuals' beliefs, behaviors, and responses can be shaped by their culture and context. As individuals embark on their career journeys, it is imperative that they recognize how cultural socialization can influence their self-efficacy and outcome expectations.

Another important aspect is that, since CS as a field involves creating software and interfaces for others to use, it is crucial to consider cultural differences when designing new CS products.

Examples:

- Curriculum acknowledges the many paths one could take when choosing a career, including how family, friends, and society may influence individuals' decisions.
- Curriculum includes content that discusses how diversity and cultural differences can expand CS applications to address everyone's needs, and not just the needs of the few (e.g., facial recognition software failing to identify African American individuals).

3.8.6 Feedback & Reflection Mechanisms (FE-RM)

Lent & Brown (2013) argue that SCCT not only explains how individuals develop interest and persist in career exploration but also addresses how they manage tasks and cope with challenges during career advancement and job searching. A CS curriculum designed with these principles in mind could foster adaptive behaviors and self-management skills, promoting career success.

Examples:

- Curriculum includes elements to promote students' reflection and appraisal.
- Curriculum includes extensive formative opportunities.
- Curriculum includes robust iterative artifact assessment mechanisms.
- Curriculum fosters an incubator-like environment where feedback is omni-directional (teacher to student, student to student, student to teacher).

Table 2 below, presents the complete SCCT rubric, including top-level codes, subcategories, and illustrative examples.

Table 2

SCCT Rubric: Top-Level Coding, Categories, and Examples

Top-Level Codes				Examples
1. SELF EFFICACY SOURCES DEVELOPMENT (SE-DE)	Enactive Mastery Experiences	Curricular content*	Clear evaluation criteria	E.g., rubrics, exemplars
			Content scaffolds/ sequence	E.g., curricular content provides skill/knowledge scaffolds as well as remedial content

			Student autonomy-based instructional strategies	E.g., problem-based, project-based, inquiry-based
			Capstone/ artifacts	E.g., unit assessments require students to produce an artifact or capstone project.
	Vicarious Experiences	Curricular content*	Curricular content utilizes graphical elements to depict women and other under-represented populations in CS	E.g., Code.org introductory videos narrated by young woman
			Curriculum includes content highlighting women in CS	E.g., content highlights women who had made significant contributions to CS, for example, Grace Hopper, Ada Lovelace
		Direct interactions*	Colleges/ university visits	
			Teachers leveraging their own experiences/ careers/ education to model career trajectories	
			Guest visits and/or mentoring	

	Verbal Persuasion	Curricular content*	Instructional content contains elements to encourage enjoyment	E.g., elements of praise and encouragement for girls and other minorities to participate
		Family/ community*	Support and/or encouragement to participate in CS courses and activities	E.g., how parents/guardians promote their children's participation in CS courses
	Physiological and Affective States	Curricular content*	Socio-emotional learning content (SEL)	E.g., Code.org positive Attitude App
		School counseling (outside of curricular content)	Online/printed resources	E.g., what type of resources are available for students?
			1:1 meetings	
	Academic Counseling	Recruitment Practices	How are students enrolled in CS courses?	E.g., by their own choice, schedule availability, others?
2. OUTCOME EXPECTATIONS ALIGNMENT (OE-A)	Curricular content*	Discussions/content about potential outcomes of an occupation	Salary	
			Lifestyle	
			Type of job/setting	
	Facilitated by parents/ guardians or outside of classroom		Skills/ education required	
			Location	
3. PERSONAL GOALS & IDENTITY DEVELOPMENT (PG-CI)	Curricular content*	Discussions/content that promotes career exploration		
		Identity/career exploration tests/questionnaires		
	Support	Career Counseling (Middle School)		
	Opportunities	Career Fairs		

		Clubs		
4. ADDRESSING BARRIERS & EQUITY IN CAREER ACCESS (AB-EQ)	Support	Curricular and/or support systems designed to support girls and/or minorities in CS		E.g., do teachers, counselors, or parents/guardians discuss barriers and equity in career access?
	Curricular content*	Discussions/content related to diversity, equity, and inclusion topics		
5. CULTURAL & CONTEXTUAL RELEVANCE (CU-CR)	Beyond the classroom	Family/community		
	Curricular content*	Culture & Traditions	Discussions/ content that highlights different cultures and traditions	
		Stereotypes	Discussions/ content about stereotypes based on gender, ethnicity, nationality, or others	
6. FEEDBACK & REFLECTION MECHANISMS (FE-RM)	Curricular content*	Self-reflection opportunities		
		Assessments	Competency-based feedback	

Note. Rubric elements marked with an asterisk (*) were added inductively based on insights that emerged during data analysis.

3.9 Validity and Reliability

To answer the research questions, a mixed-methods approach was chosen, integrating qualitative and quantitative data to ensure a comprehensive understanding of the research topic. The combination of these methods reduces methodological limitations, strengthens validity, and improves reliability. Mixed-method approaches enhance the rigor of research findings by reconciling the contextual and interpretative depth offered by qualitative analysis with the structured measurement and generalizability of quantitative analysis (Creswell & Plano Clark, 2017).

By leveraging two complementary data sources, the study triangulates findings to better assess the presence and depth of curricular elements that align with Social Cognitive Career Theory (SCCT) constructs. Yin (2004) emphasizes that triangulation involves cross-validating phenomena using independent methodological approaches, resulting in more credible and comprehensive assessments.

In this study, quantitative analysis provides structured insights into what curricular elements are present, while qualitative analysis offers interpretive depth into how these elements are implemented and the potential impacts on student learning and motivation to engage with CS topics. For example, while quantitative coding might indicate the frequency with which a specific SCCT construct is addressed in curricula, qualitative analysis explains how those constructs are integrated into lesson design and instructional strategies. Together, these data sources strengthened the credibility and depth of findings, allowing for a richer understanding of how CS curricula support constructs like self-efficacy, outcome expectations, and career-related goals.

Although data collection and data analysis were conducted by a single researcher, the study mitigated potential biases through systematic coding procedures, iterative reflection on analytic decisions, and careful alignment of findings with established frameworks. This approach ensured that the study adhered to rigorous standards of validity and reliability in mixed-method research, yielding credible and dependable results.

3.9.1 Quantitative Validity and Reliability

Quantitative validity refers to the extent to which measurement accurately capture the constructs being assessed. Reliability pertains to the consistency and reproducibility of these measures over time or across study contexts (Silverman, 2021). For this study, content analysis was applied as a systematic and repeatable method for measuring the alignment of curricular elements with categories defined in the Social Cognitive Career Theory (SCCT) rubric (see table 2). For example, curricular elements addressing gender disparities or challenges faced by women in computer science were coded under "Addressing Barriers and Equity in Career Access" (AB-RQ).

To ensure validity, coding categories were operationalized in detail, with definitions and examples provided in table 2. This ensured that curricular elements were consistently identified and accurately classified according to the SCCT rubric. Furthermore, to maintain reliability across the coding process, a reflective approach was taken in which coding decisions were continually revisited and refined throughout the analysis, ensuring consistency in application. Emerging ambiguities were documented and resolved through iterative refinement in the coding schema, ensuring clarity and precision.

3.9.2 Qualitative Validity and Reliability

Qualitative validity ensures the findings accurately reflect the characteristics and intent of the curricular elements under analysis (Lincoln & Guba, 1985). Reliability in qualitative research refers to the dependability and consistency of the analytic procedures employed. In this study, curricular elements were critically evaluated to determine their alignment with SCCT constructs, such as Self-Efficacy Development (SE-DE). For example, the analysis of curricular materials for evidence of enactive mastery experiences considered elements such as clarity of evaluation criteria, scaffolding of content, opportunities for reflection, student autonomy, and the characteristics of required students' artifacts.

To ensure validity, the analytic process employed triangulation at the methodological level, where qualitative insights were examined alongside quantitative coding results to ensure coherence across findings. For example, if curricular materials frequently addressed self-efficacy activities (verified through quantitative coding), the qualitative appraisal provided an interpretative layer to understand the depth and implementation of such activities. This convergence of methods enhanced both the validity and contextual richness of the findings.

3.10 Positionality of Researcher

According to Holmes (2020), a researcher's positionality "describes an individual's world view and the position they adopt about a research task and its social and political context"(p.1). This study is aligned with the pragmatic paradigm, commonly associated with mixed methods research (Creswell & Clark, 2011). A pragmatic approach in education reflects a worldview focused on "what works" (Weaver, 2018), emphasizing practical solutions with real-world applications. This research seeks to assess what is being taught in middle school computer science (CS) curricula and how it is implemented, with the goal of identifying elements that may foster girls' participation and engagement in CS.

In terms of the biases and experiences I bring to this research, my limited scholarly work to date has focused on expanding access to computer science education for girls in K–12 settings. However, I have not taught in K–12 schools myself. My direct experience is limited to participating in the development and co-instruction of a high school computer science course.

The entirety of my professional career has been in higher education, where I have served in various roles, including as an instructor, curriculum developer, instructional designer, technologist, hardware specialist, educational researcher, and administrator. My computer science skills are self-taught and include foundational programming in a few languages, physical computing, database management, and overall digital literacy.

Given these experiences, I consider myself an outsider to middle school culture, and by extension, to the broader K-12 educational environment.

My position regarding career access is shaped by multiple personal factors: I am a father to a daughter; I identify as racially White but culturally Hispanic/Latino; and I am the son of parents who did not attend college. These experiences inform my interest in how educational systems either support or constrain access to careers in fields such as computer science. I place a high value on both the transformative power of education and the fundamental right to choose and shape one's own future.

CHAPTER 4

RESULTS

The purpose of this study was to identify components of middle school Computer Science (CS) curricula that foster participation and engagement of middle school girls in computer science. Curriculum was defined as all planned and guided CS learning experiences, as well as the support and feedback provided by school counselors, teachers, administrators, and parents/guardians. Social Cognitive Career Theory (SCCT), which is based on a triadic relationship between self-efficacy, outcome expectations, and goals, builds the framework to identify what components of CS curricula promote self-efficacy, outcome expectations, and career goals toward CS. More specifically, this study answered two research questions (RQ) and sub-questions utilizing a convergent parallel mixed-method design.

RQ1. How does a middle school CS curriculum and ancillary services promote sources of self-efficacy for girls?

a) Which elements of the CS curriculum foster enactive mastery experiences?
b) How do elements of the CS curriculum promote positive vicarious experiences?
c) What type of CS curriculum elements and support services (e.g., teachers, counselors, family, peers) exist and how do they offer verbal persuasion towards CS?

d) What type of CS curriculum elements and support services do middle schools provide to aid female students' physiological and affective states towards CS and how do they foster participation in CS?

RQ2. Do elements of the CS curriculum that promote sources of self-efficacy align with students perceived self-efficacy, articulated career goals and outcome expectations?

RQ1a and RQ1b were addressed through curriculum assessment using both quantitative and qualitative methods, as well as qualitative responses from all administered questionnaires.

RQ1c was addressed using data from both the parent/guardian and revised staff questionnaires. This included qualitative responses from both instruments, along with quantitative responses from the parent/guardian questionnaire to gauge levels of career-related support and attitudes regarding how children should make future career decisions.

RQ1d was addressed through curriculum assessment, using quantitative methods to identify the frequency of relevant elements and qualitative methods to evaluate their quality. The revised staff questionnaire also provided qualitative data on the types of support available to help students manage their physiological and affective states.

RQ2 was primarily addressed using quantitative data collected through the CSMQ-II, a validated instrument designed to assess students' intrinsic motivation, self-efficacy, self-determination, grade motivation, and career motivation related to computer science.

4.1 Site Recruitment

Starting in Fall of 2022, and continuing until Fall 2023, attempts were made to recruit middle schools in the state of Massachusetts to participate in the study. Recruitment methods included direct emails to leadership (superintendents, principals, curriculum directors), teachers (CS and STEM instructors), and school counselors. Additionally, recruitment calls were posted on the Massachusetts chapter of the Computer Science Teachers Association (CSTA) message boards. Out of the 29 public and private schools contacted, only one decided to participate in the study.

The participating middle school is in an urban area in western Massachusetts and serves fewer than 300 students. According to Massachusetts Department of Elementary and Secondary Education (DESE), the student population is predominantly Hispanic or Latino (65%), followed by White (15%), Black or African American (13%), Asian (3%), and other racial/ethnic groups (7%). A high percentage of students are considered high needs (86%), with 80% classified as low income.

Initially, approximately 70 middle school students were eligible to participate in the study, based on their enrollment in computer science courses. Of those, 23 students returned signed parent/guardian consent forms and participated in the “Choosing a Career” presentation and focus group. Among the participants, 14 identified as girls and 9 as boys, with ages ranging from 11 to 15 years old.

4.1.1 Secondary Data Collection Recruitment

To gather additional information about middle school computer science (CS) curricula, a secondary data collection protocol was launched in February 2025 (see Appendix D). A call for participation was posted through the Massachusetts chapters of the Computer Science Teachers Association (CSTA) and the American School Counselor Association (ASCA). In addition, CS teachers, STEM educators, and support staff from schools that had previously declined to participate in the initial phase of the study were also contacted directly.

Nine participants submitted responses. Of these, seven identified as women and two as men. Eight participants reported having a master's level education, and all are employed at public middle schools. In terms of professional roles, five identified as STEM teachers, three as CS teachers, and one as a school counselor. Regarding race/ethnicity, all but one identified as White; one participant identified as Black or African American.

4.2 Data Results

Given the variety of data collection methods used in this study, methodological triangulation process was employed to integrate and cross-validate different types of information, ensuring a comprehensive approach to addressing each research question and its corresponding sub-questions.

In the following, results will be presented for each RQ and sub-questions.

4.2.1 Research Question 1

RQ1: *"How does a middle school CS curriculum and ancillary services promote sources of self-efficacy for girls?"*

This question specifically examines the extent to which curricular components support Bandura's (1997) four sources of self-efficacy: enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states and which are addressed in the sub questions accordingly. To explore the presence and extent in which the four sources of self-efficacy are reflected or supported within the curriculum and related support services the SCCT rubric was utilized as well as data from other sources such as the student focus group.

The CS curricula reviewed in this study incorporate a mix of custom-developed units and third-party resources, including both free and subscription-based. The analysis focused on the one unit titled “Creating Apps with Devices (micro:bit) (’24-’25)” developed by Code.org that the participating school implemented. This unit spans six weeks and is designed for a total instructional time of approximately 225 minutes per week (3 hours and 45 minutes). The unit includes 17 lessons presented through various modalities, including text, video, and interactive coding platform.

4.2.1.1 Which elements of the CS curriculum foster enactive mastery experiences?

Mastery experiences are the most influential source in Bandura’s self-efficacy (1997) framework, as they offer the most authentic evidence of an individual’s capabilities. While leveraging the SCCT rubric to appraise Code.org’s Creating Apps with Devices (micro:bit) (’24-’25) unit, I identified five different components that support the development of enactive mastery experiences: clear evaluation criteria, content scaffolds, opportunity for reflection, elements that support children’s autonomy to exercise control, and educational units must lead to capstone projects/artifacts. Table 3 lists examples of these components that provide students with opportunities to demonstrate their ability to successfully complete a task.

Table 3

CS Curriculum Alignment with Mastery Experience Components (SCCT Rubric)

Mastery Experience Component (SCCT Rubric)	Examples
1. A Clear Evaluation Criteria	Each lesson includes multiple curricular components with embedded formative assessments. Additionally, two summative projects are featured in Lessons 10 and 17, each accompanied by post-project tests designed to assess learning outcomes not fully captured by the project rubrics.
2. Content Scaffolds	This unit can be used as a stand-alone introduction to programming. It begins with an overview of the interactive coding interface "App Lab," followed by a gradual introduction to programming concepts. Early lessons focus on modifying existing code by selecting variables from drop-down menus within pre-built programming blocks. Subsequent lessons introduce block-based coding, asking students to drag blocks into the workspace and begin customizing instructions. Each lesson builds in complexity by adding new coding blocks and expanding the number of variables students can manipulate.
3. Opportunity for Reflection	The curriculum does not incorporate self-reflection tools directly within the software interface. However, the accompanying teacher lesson plans recommend a five-minute "Wrap Up" period at the end of each class for group discussion. Suggested prompts include: What was positive? What was difficult or frustrating? and other curriculum-related topics. Additionally, if time permits, students are encouraged to record their reflections in a learning journal to be maintained throughout the unit. The curriculum also includes a pre-survey to assess students' predispositions toward computer science and school, as well as their prior experience with CS (baseline data). Although a series of end-of-unit surveys are mentioned, they are unfortunately not accessible for review.
4. Elements that Support Children's Autonomy to Exercise Control	The unit's structure is fixed, and assessments cannot be modified; components must be completed sequentially, although students can engage with the content in a flexible order.

5. Educational Units Must Lead to Capstone Projects/Artifacts	All lessons include formative exercises that scaffold learning toward the development of final artifacts. Lesson 10 (Project: Human-Device Interaction) and Lesson 17 (Project: Prototype an Innovation) are project-based and serve as culminating experiences, requiring students to apply concepts and skills from the entire unit to create meaningful artifacts.

While the unit clearly defines evaluation criteria, scaffolds content effectively, and culminates in the creation of artifacts, it lacks opportunities for student self-reflection and offers limited flexibility. Although learners can progress at their own pace, the content's structure is fixed and not customizable.

4.2.1.2 How do elements of the CS curriculum promote positive vicarious experiences?

According to Bandura's (1997) self-efficacy model, vicarious experiences serve as an additional source of validation by allowing individuals to assess their ability to complete tasks through observation. These experiences provide a basis for comparison, enabling individuals to evaluate their own performance relative to that of others. Furthermore, these evaluations can be associated not solely by performance attributes but also by perceived similarities in personal characteristics, including "age, gender, education level, socioeconomic status, race, and ethnicity" (Bandura, 1997, p. 98).

As a result, curricular elements were analyzed to develop a profile of each student's family support system, including the educational background and occupations of parents, guardians, and extended family members to ascertain the potential influence of these groups. Curricular materials were also reviewed to assess whether they depicted individuals from underrepresented populations in computer science (e.g., women and ethnic minorities). In addition, the curriculum was examined for evidence of connections to mentors or higher education institutions that could serve as role models.

Highlighting CS Professionals and Colleges and Universities that Offer CS Degrees.

CS and STEM instructors reported incorporating their own professional experiences as programmers or scientists into their teaching. These first-hand accounts help students gain insight into real-world applications of CS. One instructor noted, “Yes, as a female I am an example of a woman in a traditionally male role.” Another highlighted the integration of cultural observances, such as Black, Women’s, Latino, and Native American History Months, to spotlight underrepresented populations in CS.

Additionally, the CS instructor from the participating school shared that she and her students were invited to visit Worcester Polytechnic Institute (WPI) for sessions led by students and faculty. She emphasized the strong representation of women from diverse backgrounds among the presenters, offering students powerful examples of inclusivity in the CS field.

Parents’s/Guardian’s and Extended Family Role Models.

Children are often first exposed to potential occupations by observing the behaviors and careers of their parents and guardians (Abdul Rahaman et al., 2023). During the focus group, several students expressed interest in pursuing careers similar to those of their family members. Examples included statements such as, “I’m going to join the Marines like my dad and uncle,” and “I love working on cars with my dad; I’m going to be a mechanic.” However, when parents and guardians were asked in the questionnaire whether they believed their child would follow in their footsteps (Question 2), the responses told a different story: out of 22 responses, 4 selected Strongly Disagree, 15 chose Disagree, and only 3 selected Agree. It is possible that parents and guardians interpreted this question not literally, but as a reflection of their aspirations for their children, perhaps hoping their child will have opportunities to surpass their own career paths.

When reviewing students' responses to the question, "I know you are in middle school, but you might have already thought about what to do after school, what your future career might be…" (Student Questionnaire), and comparing them with the occupations reported by their parent/guardian or extended family, there was alignment in 7 out of 23 cases. In these instances, the student's career aspiration matched the current occupation of their parent or guardian. In the remaining 16 cases, the occupations students aspired to were not represented within their immediate family, indicating that their career interests extended beyond the professional paths of their parents or guardians.

Table 4 outlines the professions that students are interested in pursuing, alongside the professions of their parents or guardians.

Table 4

Student Desired Profession and the Professions of their Parents/Guardians and Extended Family

Student's Desired Profession	Parents/Guardians, Spouse - Extended Family Professions
"I want to join the Navy because it seems fun" (g)	Program manager, mechanical assembler - pilot, university professor
"I want to be a psychiatrist when I grow up. This is because I am interested in it" (g)	Licensed mental health counselor, barber shop owner - ultrasound technician, pilot, police, business owners

"Either a business women or a doctor/nurse because with a business I am able to learn how doing things by myself is. Doctor/nurse because I want to help people" (g)	Left blank - business, photography, technology
"I want to be some sort of nature scientist because I love learning and sharing things about nature" (g)	Higher education administration, musician and higher education educator - educators, musicians, business professionals, medical professions
"I want to be in the Army" (b)	Certified Nursing Assistant (CNA), material handler - left blank
"What I want for my future career is a nurse that helps with pills and patients. So basically assistant nurse. Another type of nurse is one that checks a baby of a women"(g)	Nurse - nurse, teacher
"I want to be a fashion designer because I had 4 had a sense for fashion" (g)	Stay at home, carpenter - Fedex delivery, farmer, nurse
"I have many ideas on what I wanna be & the things I want my career to be connected to. But as long as I get many would be a good option. Things I want my job to contain would be sports (soccer), ability to travel so I don't have to stay in one place, art, animals?, etc." (g)	Special education teacher, N/A - social workers, teachers, paraprofessional, IT, lawyer
"Cosmetology, Culinary, real state, or nursing" (g)	Retired - electrician, social worker
"My future career might be painter or enggeir (engineer) I like the way art show me and I like" (b)	Certified Nursing Assistant (CNA) - N/A
"I want to be a DJ" (b)	Lead correctional officer, union carpenter - college adjunct professor, realtor, middle school science teacher, police, Japanese translator, computer programming
"I want to be an engineer. The reason why I want to be an engineer because I like working with technology. Since its super cool." (b)	Medical assistant - truck driver, operator, demolition, home healthcare

"Cosmetology" (g)	Chiropractic assistant, lead quality inspector – retired first sergeant (Marine Corps), retired teacher, admin assistant/medical records
"My future career is being a Doctor" (g)	Foster mother, personal care aide, electric assembler - pharmacist, technicians, cosmetology
"I don't know what I want to be but maybe cosmetology" (g)	Quality control inspector, customer service representative - church pastor, PCA worker
"Pediatrician and if that doesn't work then cosmetology"(g)	Business development manager - principal, broker, engineer, teacher, vet
*"I want to be a fornight player. I want to be in the nfl when I get older and to be in NFL for my dad and mom for my *(not sure) forever"* (g)	Retired - electrician, social worker
"I want to be a business owner of a shoe store because I like shoes" (b)	Aviation safety inspector - nurse, postal worker, web design
"I want to become a neurosurgeon or do cybersecurity because I am interested in learning about the brain and because cybersecurity uses computer science/code" (g)	Certified community health worker - sociologist, astrologist
*"Go to work and try to get to be *(undecipherable)"* (b)	Education support specialist, machinist - chemical engineer, teacher
"I want to be an electric engineer because I like working with computers and I like coding" (g)	Accountant, sheriff's deputy - machine operator, construction assembler
"I want to be a sports player for soccer but I, also I want to do a effect apper (app developer) maybe a game for kids"(b)	Student, truck driver - mailman, truck driver, human resources
"A career I have thought of doing in the future is something with sports" (b)	Left blank - truck driver, nurse, police officer

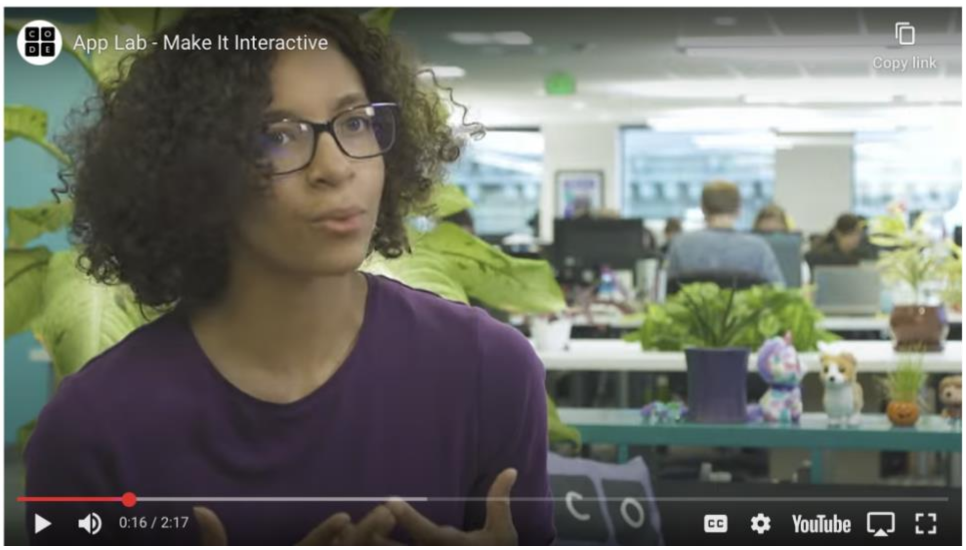
Note: Statements are presented as recorded by each student. Participant's gender is denoted by (b) for boy or (g) for girl.

Curricular Elements and Activities.

The "Creating Apps with Devices (micro:bit) ('24–'25)" developed by Code.org, includes only one instance of curricular elements depicting diverse people engaging with CS tasks. The sole example in the entire unit occurs during the App Lab introductory video and is hosted by a young, non-white woman (see Figure 2).

Figure 2

Make it Interactive Video Screenshot (Code.org)



The remaining instructional materials in the 'Creating Apps with Devices (micro:bit) ('24–'25)' curriculum focus exclusively on programming concepts, without depicting individuals in any lessons. Programming is presented in a depersonalized manner, emphasizing functionality and the intrinsic value of the tasks, rather than highlighting (Bandura, 1997) human users or social context.

4.2.1.3 What type of CS curriculum elements and support services (e.g., teachers, counselors, family, peers) exist and how do they offer verbal persuasion towards CS?

Bandura (1997) states that when significant others express confidence in an individual's abilities, it can help sustain a sense of self-efficacy, even in the face of adversity. This research sub-question is addressed by triangulating data from three sources: responses from parents and guardians, middle school career counseling and support practices, and curricular elements that offer encouragement and promote participation in computer science courses and activities.

Parents'/Guardians' Career Decision Support.

To better understand parents' and guardians' level of support and their children's autonomy in making career decisions, the parent's/guardian's questionnaire included two items on a 4-point Likert scale (Strongly Disagree, Disagree, Agree, Strongly Agree):

- Deciding a career, or path of study, is a joint parent/guardian and child decision.
- I support wholeheartedly my child's decision to embark on a career/field of study.

Table 5 presents the aggregate mean responses for all children and parent's/guardian's child by gender.

Table 5

Parents/Guardians Level of Support and Autonomy to Make Career Decisions by Gender

Question	All Children (n=23)	Girls (n=14)	Boys (n=9)
Deciding a career, or path of study, is a joint parent/guardian and child decision.	2.16	2.5	1.88

I support wholeheartedly my child's decision to embark on a career/field of study.	3.66	3.85	3.77

Note: Scores are based on a 4-point scale (1=Strongly Disagree, 2=Disagree, 3=Agree, and 4=Strongly Agree) average.

Parents/guardians level of support and autonomy responses were not significantly different for all children. The data suggests that parents and guardians tend to grant boys slightly more autonomy in making career decisions (mean score: 1.88, leaning toward "Disagree") than girls (mean score: 2.5, between "Disagree" and "Agree"). However, when it comes to supporting their child's chosen career path, no differences were found; girls averaged 3.85 and boys 3.77, both falling within the "Strongly Agree" range.

Although these two questions are not specific to computer science, they may reflect a general willingness to support whatever career path a child ultimately chooses. Broad parental or guardian support for any career choice can positively influence a child's self-efficacy development. According to Bandura (1997), such encouragement represents a form of verbal persuasion, one of the sources of self-efficacy.

School's Support Towards Participation in CS Courses and Activities.

Based on responses from middle school personnel, including CS and STEM teachers and school counselors, computer science courses at the middle school level may be offered as either electives or required subjects. Of the nine participants who completed the revised staff questionnaire, five reported that CS is offered as an elective, while four indicated it is a required component of the curriculum.

In schools where CS courses are required, both girls and boys are typically enrolled automatically. However, in schools where CS is offered as an elective, student participation is more likely to depend on the effectiveness of recruitment and referral practices. In these cases, encouragement from school counselors and teachers plays a critical role. Such encouragement can be understood as a form of verbal persuasion, one of the key sources of self-efficacy within the framework SCCT. This kind of support may be a determining factor in whether girls choose to enroll in CS courses.

When I asked one of the teachers about recruitment efforts, she noted uncertainty about the enrollment process at her school, describing it as seemingly arbitrary. She explained that in some cases, students and parents had specifically requested placement in CS classes but were not accommodated, while other students who had expressed no interest, or even a desire not to participate, but were enrolled regardless.

One teacher described a strategy in which, as 5th graders transition from elementary to middle school, they visit the middle school and attend short introductory sessions where teachers showcase various elective options, including computer science.

Another respondent noted, "It is totally their choice," highlighting that there were no additional systems in place to encourage participation.

One respondent noted that while there was general encouragement to participate in CS courses at the academy where he worked, some students still struggled to feel a sense of belonging in those classes (physiological and affective states).

Curriculum Built-In Support Features.

The content in *"Creating Apps with Devices (micro:bit) ('24–'25)"* developed by Code.org includes written instructions and informational statements throughout the entire unit. The excerpt in Figure 3 is representative of the tone, supportiveness, directness, and light personalization found consistently across all lessons. The tone can be described as friendly and encouraging, with phrases such as "you're interested in" and "you can experiment," which convey a sense of learner autonomy. The consistent use of the second-person voice ("you") helps engage learners directly, fostering a conversational feel, even though learner's names are explicitly used. Overall, the writing is clear and slightly informal; for example, the phrase "there's a few more blocks…" (instead of the grammatically formal "there are") adds a friendlier tone rather than strict formality.

Figure 3

Language Used in Instructions/Content Within Code.org's Creating Apps with Devices (micro:bit) ('24–'25)

Goal: Build your own app by extending this project. Then "Share" it with someone!

How: Decide what type of app you're interested in building. Then go build it by adding more screens, buttons, text, sound, and user interactions to your app. There's a few more blocks in the toolbox that you can experiment with as well. Once you're done click "Share" to send it to yourself or a friend!

Note: Lesson 1 – Intro to App Lab part 15

4.2.1.4 What type of CS curriculum elements and support services do middle schools provide to aid female students' physiological and affective states toward CS and how do they foster participation in CS?

Similarly to other sources for Bandura's (1997) self-efficacy construct, physiological and affective states can influence an individual's decision to engage with a task. For instance, existing gender stereotypes may discourage girls from participating in computer science (CS) courses and activities. Because physiological and emotional responses are integral to the development of self-efficacy, and to Social Cognitive Career Theory (SCCT) more broadly, it is essential that CS curricula include elements that help students manage the emotional challenges that may arise when engaging in potentially stressful or unfamiliar activities.

This research sub-question is addressed by examining the resources available to support students' physiological and emotional well-being as they relate to CS engagement. School staff were asked to describe the types of support offered, and the extent to which students' emotional needs are addressed by school counselors or other available support services.

Support From Teachers and School Counselors.

The staff questionnaire included several questions designed to identify the types of resources currently offered for school and career counseling. These questions included: "In your role, do you currently teach/facilitate sessions about career counseling?"; "In your role, have you had opportunities to discuss with students traditionally gendered roles in careers/jobs? (For example, 87% of registered nurses in the U.S. are women; BLS, 2022)"; "In your role, do you have opportunities to provide encouragement for girls to participate in traditionally male dominated courses/activities like computer science?".

A school counselor indicated that she facilitates two different instructional blocks for each grade level: an advisory block and a content block. These sessions focus on social-emotional learning (SEL) topics and general career exploration, including information about career technical education (CTE). IT is not clear if these discussions focus on broad SEL strategies and general career pathways, or if they address CS-specific content or career opportunities.

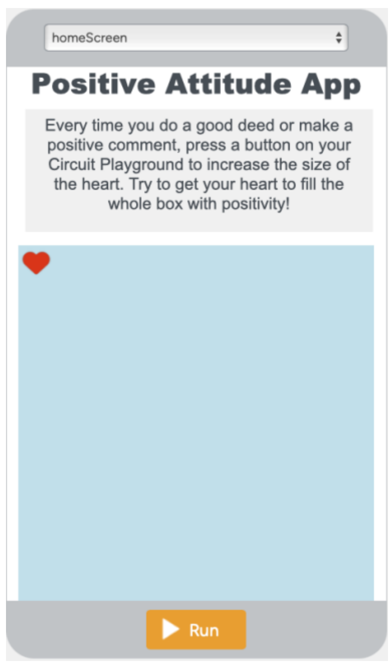
One of the CS instructors shared strategies he has implemented to foster a sense of belonging in his courses for both boys and girls. He noted that integrating music and gaming into CS content has been effective in engaging boys. To increase girls' interest and participation, he is considering incorporating fashion-related applications of CS, such as wearable technologies.

CS Curriculum Built-In Features and Connection to SEL Topics.

The "Creating Apps with Devices (micro:bit) ('24–'25)" developed by Code.org, unit includes built-in features aimed at promoting motivation and self-care (see Figure 2).

Figure 4

Positive Attitude App (Code.org)



Note: Throughout the Code.org web-based interface, there are mechanisms for students to self-report their emotional responses during engagement with the module.

4.2.1.5 RQ1 Summary.

Overall, the CS curriculum includes many elements that align with SCCT principles, particularly in supporting self-efficacy source development. However, a closer examination reveals that some elements are either insufficiently aligned with SCCT principles or altogether absent.

For example, when evaluating curricular elements for their support of mastery experiences (RQ1a), I applied the five-point criteria from the SCCT rubric: 1) presence of clear evaluation criteria; 2) scaffolded content; 3) opportunities for reflection; 4) elements that support student autonomy; and 5) inclusion of capstone projects or artifacts. The unit developed by Code.org demonstrates some strengths in this regard. It includes a clear evaluation criterion, for instance, students must complete all parts of each lesson to advance, and each lesson involves creating multiple artifacts. However, the interface lacks a feedback mechanism for student submissions. As a result, students may progress through lessons without having satisfactorily completed assignments. While the interface provides exemplars to guide students, it does not assess the quality of submitted work nor prompt for students' self-reflection. Although the accompanying teacher materials recommend reflective activities, such as maintaining a learning log, these are not embedded into the platform itself. Furthermore, the unit appears to be designed primarily for individual work, with limited opportunities for collaborative learning. While some lessons are structured around problem-solving, they do not explicitly encourage or support group work.

After appraisal, the curriculum demonstrated several instances where vicarious experiences were promoted (RQ1b). These included instructors sharing their own professional experiences, class visits to local colleges with opportunities to interact with CS students, student exploration of family members' professions, and curricular content that featured diverse role models. In some cases, there appeared to be alignment between students' prospective careers and the professions of their family members. However, the curriculum did not include a formal mentorship program and lacked consistent representation of diverse characters throughout its materials.

In terms of verbal persuasion (RQ1c) and physiological and affective states (RQ1d), these appear to be the areas where CS curricula may require the most improvement. While classroom-based verbal persuasion and emotional support can take many forms, the absence of direct classroom observations in this study makes it difficult to assess how frequently these supports are provided during instruction. From the parent/guardian perspective, two questions in the questionnaire explored: 1) how supportive they were of their child making career decisions, and 2) how much autonomy they would allow when choosing a career. Most parents/guardians expressed strong support for their child's prospective chosen career path and affirmed their autonomy in decision-making. Only a few responses suggested that career decisions should be made jointly with parents.

Neither the curriculum appraisal nor staff questionnaire responses revealed intentional efforts to address students' emotional well-being or physiological and affective states because of participation in CS courses. The only relevant curricular instance was in the Code.org unit, which included a prompt for students to note when they had performed a good deed or made a positive comment. Additionally, the school counselor's responses did not reference addressing students' emotional responses within this context either. One area of opportunity is the role of school counselors in supporting girls who may be reluctant to participate in CS. Such support could involve collaboration with CS teachers or providing individualized guidance outside the classroom that may inform recruitment and encouragement practices.

In the next section we will discuss results for RQ2.

4.2.2 Research Question 2

RQ2: *"Do elements of the CS curriculum that promote sources of self-efficacy align with students perceived self-efficacy, articulated career goals and outcome expectations?"*

This section integrates findings from both qualitative and quantitative data sources to evaluate the alignment between curricular elements and the core constructs of Social Cognitive Career Theory (SCCT). Specifically, the Computer Science Motivation Questionnaire II (CSMQ-II) was used to assess students' levels of intrinsic motivation, self-efficacy, self-determination, grade motivation, and career motivation related to computer science. The following subsections explore potential correlations between students' career motivation scores and their potential impact on career goals, and outcome expectations.

4.2.2.1 Student Questionnaire (CSMQ-II).

This study employed the CSMQ-II, a modified version of Glynn et al.,'s (2011) Science Motivation Questionnaire II (SMQ-II). The instrument consists of 25 items and demonstrates high internal consistency $\alpha > .90$. CSMQ-II reliability was verified using Cronbach's alphas and the coefficients for each subscale are as follows: career motivation (0.900), intrinsic motivation (0.89), self-determination (0.715), self-efficacy (0.746), and grade motivation (0.787), with 25-items combined coefficient of .898. According to DeVellis & Thorpe (2021), coefficients between .70 and .80 are respectable, and between .80 and .90 are very good.

CSMQ-II items are organized into five subscales: intrinsic motivation, self-efficacy, self-determination, grade motivation, and career motivation.

Table 6 shows the aggregate scores for each of the CSMQ-II subscales, reported as means of all participants and by gender. Scores for each question are based on a 4-point Likert scale (Never (1), Rarely (2), Often (3), Always (4)), while scores for each subscale range between 4 and 20.

Table 6

Aggregate CSMQ-II Scores Girls and Boys, Girls, and Boys

Subscale	All n=23	SD	Girls n=14	SD	Boys n=9	SD
Intrinsic Motivation	12.45*	3.35	12.53*	3.06	12.37*	5.48
Self-Efficacy	12.65	3.83	13.17	3.16	12.12	6.13
Self-Determination	12.47**	2.95	12.07**	2.85	12.8	5.10
Grade Motivation	15.85***	3.07	15.71***	3.33	16	5.79
Career Motivation	13.26	4.06	13.28	3.50	13.25	6.41

Note: Scores for each subscale were summed and then averaged across the entire group, as well as separately for girls and boys, by dividing the total score by the number of participants within each group.

*One girl and one boy did not answer one of the questions in this subscale.

**One girl did not answer one question in this subscale.

***One girl did not answer one question in this subscale.

When comparing aggregate scores between girls and boys, most differences were not statistically significant, except for self-efficacy. Girls reported higher self-efficacy scores (13.17) compared to boys (12.2), a difference of over one point. Notably, most subscale scores clustered around the midpoint of 12.5, with the exceptions of grade motivation and career motivation, which were comparatively higher.

Standard deviations for boys' subscale scores were significantly higher than those for girls, suggesting greater variability in motivation levels among boys within the sample.

Following Glynn and colleagues (2009), scores for each subscale were categorized as follows: low motivation (5–10), moderate motivation (10–15), and high motivation (15–20). For this study's, aggregate scores indicate that intrinsic motivation, self-efficacy, self-determination, and career motivation fall within the moderate motivation range (12 to 13 range). In contrast, grade motivation falls with a mean of 15.85 within the high motivation category.

Using Welch's t-test, girls and boys subscale scores display p-values that are higher than 0.05, otherwise indicating that that there are no significant differences between girls and boys scores across any of the motivational subscales in this sample (See table 7).

Table 7

Welch's t-test Results CSMQ-II Subscales Scores For All (Girls and Boys)

Subscale	t-value	df (approx)	p-value
Intrinsic Motivation	0.083	~12.5	0.935

Self-Efficacy	0.504	~10.6	0.623
Self-Determination	-0.399	~11.3	0.698
Grade Motivation	-0.146	~10.8	0.887
Career Motivation	0.011	~10.1	0.991

Measuring Perceived Self-Efficacy in CS Contexts.

Students' self-efficacy scores remained around the midpoint of 12.5, with an average of 12.65 overall, 13.17 for girls, and 12.12 for boys. Within the context of this study, these scores suggest there is room to strengthen CS curriculum offerings to better support students in developing CS mastery. As discussed in previous research questions, there are additional opportunities to enhance other sources of self-efficacy, such as vicarious experiences, verbal persuasion, and support for physiological and affective states. Revising the curriculum to more intentionally incorporate these sources could potentially lead to higher overall self-efficacy scores.

Exploring Career Goals and Outcome Expectations.

Articulating career goals and understanding the outcome expectations associated with pursuing a CS career are important components of SCCT that could be more thoroughly integrated into the CS curriculum. None of the questionnaire responses mentioned opportunities for students to formally discuss or set career goals. However, there were references to exposing students to computer science as a career path, including information about potential job roles, required education, and salary expectations (i.e., outcome expectations).

When considering scores students' scores in the CSMQ-II's career motivation subscale, these scores are designed to assess students' belief that learning computer science is important for achieving future career goals (Glynn et al., 2011). The average subscale scores were 13.26 overall, with 13.28 for girls and 13.25 for boys. While these scores are only slightly above the midpoint of 12.5, they suggest that students perceive computer science as moderately relevant to their occupation. It appears that, in this case, current CS curricular offerings may not be sufficiently influencing students' perceptions of CS as a viable part of their future career plans.

Another noteworthy subscale is grade motivation, with an average score of 15.85 overall, 15.71 for girls, and 16.0 for boys. Grade motivation is generally considered an extrinsic motivator, where students focus more on achieving high marks than on developing deep understanding. These elevated scores suggest that, for this group of students, grades may play a stronger motivational role than intrinsic factors such as enjoyment, career interest, or autonomy, as reflected in the other CSMQ-II constructs.

4.2.2.2 RQ2 Summary.

CSMQ-II student scores indicate that this group demonstrates slightly above-average levels of self-efficacy and career motivation toward computer science. However, their motivation to earn high grades is significantly higher.

While we cannot conclude that a CS curriculum fully aligned with SCCT principles would inherently result in higher self-efficacy and career motivation scores, the current findings suggest there is room for improvement; especially for increasing student self-efficacy toward CS.

In terms of what can be done, RQ1 identified several areas where SCCT elements were present in the curriculum but also revealed opportunities to enhance and expand those elements further.

In the next and final chapter, I will present the conclusions of this study and offer recommendations based on the findings.

CHAPTER 5

DISCUSSION AND CONCLUSION

5.1 Discussion

The purpose of this study was to explore whether middle school computer science (CS) courses and activities may serve as early catalysts for girls to pursue a career in the field. Grounded in Social Cognitive Career Theory (SCCT), this study operates under the assumption that when the core elements of SCCT (self-efficacy, outcome expectations, and goals) are positively cultivated early in a student's academic journey, the likelihood that girls will engage and persist in CS pathways increases. Conversely, when girls are not given opportunities to build self-efficacy in CS or to understand potential outcomes of a career in the field, their ability to set meaningful goals toward pursuing CS may be diminished.

The previous chapter described the results from data collected from students, their parents, and their teacher at one middle school in Massachusetts (questionnaires, focus group, interviews, a curriculum analysis, and questionnaire responses from seven computer science and STEM teachers, one school counselor, and one other staff member from middle schools across the state. They represent a snapshot in time from one course (one data point), supplemented by a small sample of nine middle school CS curricular offerings across Massachusetts. These findings are not intended to represent the general state of CS curricula across the state.

This chapter discusses the key findings of the study and situates them within the broader body of literature on how CS curricula can promote participation in CS-related careers. It also provides actionable recommendations and outlines directions for future research.

5.1.1 Current State of CS Education in Middle School in Massachusetts

According to the Massachusetts Department of Elementary and Secondary Education, as of 2024, 171 out of 398 school districts reported offering digital literacy and/or computer science courses at the middle school level (DESE, 2024a). Despite the adoption of K–12 Digital Literacy and Computer Science (DLCS) standards in 2016, implementation across districts remains inconsistent.

5.1.2 Current State of Career Counseling in Middle School in Massachusetts

Currently, career counseling opportunities at the middle school level are not consistently available across Massachusetts. While the American School Counselor Association (ASCA, 2021), advocates for career development at all grade levels, its implementation often takes a back seat due to the competing demands placed on school counselors such as performing non-counseling tasks and/or duties (Sanders et al., 2017, p. 239). Additionally, Sanders and colleagues (2017), report that counselors tend to spend only about 12.15% of their time on career-related tasks and activities.

Given that school counselors can play a key role in promoting, and at times mitigating, sources of self-efficacy such as verbal persuasion and physiological and affective states, they represent a critical support element in fostering student engagement with CS courses and activities. As such, school counselors have the potential to meaningfully contribute to a curriculum that promotes girls' interest and sustained participation in computer science.

5.2 Implications

This research aims to provide a snapshot of current CS curricular offerings in middle schools across Massachusetts. Utilizing SCCT to guide the process, this study operates under the assumption that when the core elements of SCCT (self-efficacy, outcome expectations, and goals) are positively cultivated early in a student's academic journey, the likelihood that girls will engage with and persist in CS pathways increases. Conversely, when girls are not given opportunities to build self-efficacy in CS or to understand the potential outcomes of a career in the field, their ability to set meaningful goals toward pursuing CS may be diminished.

5.3 Recommendations

This study's research questions (RQ1 and its sub-questions, and RQ2) aimed to assess whether, and to what extent, CS curricula include elements that support the core constructs of Social Cognitive Career Theory (SCCT). RQ1 focused on appraising the presence and quality of SCCT components within CS curricula. Data analysis revealed that career counseling was not widely integrated, limiting students' opportunities to set career goals or explore potential career outcomes and expectations in CS. Additionally, several other curricular areas, such as teaching strategies, opportunities for self-reflection, intentional inclusion of content addressing barriers and equity in career access, and improved recruitment practices, were found to be underdeveloped or missing. RQ2 offered further insight into how well CS curricula could foster students' self-efficacy and motivation to pursue a CS career, reinforcing the notion that there is room for improvement.

Overall, the findings of this study have led to three key recommendations aimed at increasing girls' interest in CS careers. These recommendations may also serve as strategies to promote engagement and interest in other career pathways.

5.3.1 Normalize Career Counseling in Middle School

Currently, it would appear career counseling is not widely implemented across middle schools in Massachusetts. Although questionnaire responses generally supported the value of career counseling at this level, there was limited agreement on its scope and depth. A potential starting point for standardizing and strengthening career counseling is recognizing its importance in middle school, as recommended by Field (2022), ACTE (2017), Sanders et al., (2017). Increasing the time school counselors dedicate to career counseling could also enhance its impact; however, this may be challenging given their numerous competing responsibilities (Sanders et al., 2017). The following outlines four recommendations, grounded in elements of Social Cognitive Career Theory (SCCT), that this study found to be either limited or absent in current middle school offerings:

1. Introduce Career Outcomes: Help students explore potential outcomes of various careers, including salary, lifestyle, work environment, and educational requirements. Activities might include career fairs and guest speakers.
2. Teach Goal-Setting Strategies: Support students in developing personal and academic goals. Encourage reflection on how short-term goals can align with long-term aspirations.
3. Incorporate Self-Efficacy Principles into Curriculum: Bandura (1997) sources of self-efficacy can be leveraged to design curricula that offer students opportunities to build mastery, compare their performance to meaningful benchmarks, receive

encouragement to participate and persist, and address their physiological and emotional well-being. These factors are especially important in subjects like computer science, where girls may opt out due to the magnitude of perceived or actual barriers.

4. Identify and Address Barriers to Participation: Assess and mitigate barriers that may prevent, especially girls, from engaging in CS courses and activities. This may involve addressing stereotypes, providing mentorship, or ensuring equitable access to resources.

The recommendations outlined above, introducing career outcomes, teaching goal-setting strategies, incorporating self-efficacy principles, and identifying and addressing barriers to participation, offer practical ways to enhance career counseling conversations and activities in middle schools. These strategies could be effectively implemented through partnerships between school counselors and CS teachers, working collaboratively to integrate these elements into curriculum development.

5.3.2 Intentional Implementation of Principles of Self-Efficacy Source Development into Curricular Design

According to Bandura (1997), self-efficacy refers to an individual's belief in their ability to succeed in a particular task. When individuals believe they can succeed, their likelihood of engaging in and persisting with that task increases. By integrating activities/experiences that support and strengthen Bandura's four sources of self-efficacy; enactive mastery experiences, vicarious experiences, verbal persuasion, and physiological and affective states, into curricular design, educators can foster the development of positive self-efficacy across a variety of learning activities.

This study identified a range of strategies that support the development of self-efficacy. For instance, to foster enactive mastery experiences, curricula should incorporate the following five elements:

1. Clear evaluation criteria;
2. Scaffolding of content to support gradual learning;
3. Opportunities for students to reflect on their learning (e.g., what was helpful, what was challenging, and how the learning connects to their future goals);
4. Curricular structures and supports that foster student autonomy (e.g., opportunities for input on learning activities, or strategies like problem-based learning that encourage independent thinking);
5. Capstone projects or culminating artifacts that demonstrate skill mastery.

Incorporating these elements into curriculum design, from the overall structure down to individual units and lesson plans, can help guide instructional and assessment strategies, shape content delivery, and inform the types of support needed to enhance student engagement and persistence.

5.3.3 Emphasis on CS, What About Other Careers?

This study aims to increase girls', and subsequently women's, participation in CS occupations. Expanding women's representation in CS not only promotes diversity in the workforce but also opens access to high-paying careers (BLS, 2024), given that many CS roles offer significantly higher-than-average salaries.

However, enhancing curricular offerings to support this goal requires as outlined above resource investment, e.g., hiring of more career counselors, or supporting professional development for teachers to enhance unit and lesson plans with elements supporting self-efficacy. This raises an important question: Why prioritize CS over other fields/professions? Shouldn't students be equally exposed to a broader range of careers? A potential solution may be implementing broader Career and Technical Education (CTE) programs. For instance, Advance CTE (2023), which has developed a career framework based on 14 major career clusters and 72 sub-clusters, covering diverse industries such as finance, education, healthcare, and advanced manufacturing, which includes specialties like robotics and automation.

This study does not propose that computer science education or CTE programs be the sole pathway to a career. Instead, from the perspective of Social Cognitive Career Theory (SCCT), it is essential that students have meaningful learning experiences that foster self-efficacy. Having strong self-efficacy might motivate girls to pursue careers in fields like CS even though role models or other support structures are less easily available than in other careers. Without such experiences, students may miss opportunities to develop the confidence and motivation to pursue careers in fields like CS. Likewise, without exposure to a field, students may not have the necessary information to evaluate whether their goals and outcome expectations align with the reality of that profession. In this context, the old adage rings true: "You never know until you try."

5.4 Potential Future Factors

As the priorities of Massachusetts residents and lawmakers continue to evolve, structural changes are underway that may influence how CS is taught in middle schools and what higher education opportunities are available to pursue CS-related careers. The following section explores two recent policy shifts that are likely to have a significant impact on the future of CS education and career pathways in the Commonwealth. This section also examines the initial effects Generative Artificial Intelligence (GAI) has had on computer science professions and offers insights into potential near-term developments.

5.4.1 MCAS Removal

In November 2024, the electorate of Massachusetts voted Yes on Question 2: Elimination of Massachusetts Comprehensive Assessment System (MCAS) as a High School Graduation Requirement. The proposed law, via petition, pursued "the elimination of the requirement that a student pass the MCAS tests (or other statewide or district-wide assessments in mathematics, science and technology, and English in order to receive a high school diploma" (Galvin, 2024, p.10).

Through questionnaire responses and direct conversations with teachers, it became evident that MCAS-tested subjects (English Language Arts, Mathematics, and Science) take precedence over all others. Although Computer Science (CS) is categorized under STEM, it is not assessed by MCAS, and therefore is often deprioritized, especially as testing time approaches. This marginalization is further supported by findings from the revised staff questionnaire, where just over half of the respondents indicated that CS courses are offered as electives.

Although it is still too early to evaluate the full impact of removing MCAS scores as a high school graduation requirement, this shift represents an ideal moment for middle schools to reassess how instructional time and academic priorities are allocated across subjects. Computer and digital literacy are no longer optional skills, they are essential. As stated in the Massachusetts Digital Literacy and Computer Science (DLCS) standards: "digital literacy and computer science knowledge, reasoning, and skills are essential both to prepare students for personal and civic efficacy in the twenty-first century and to prepare and inspire a much larger and more diverse number of students to pursue the innovative and creative careers of the future" (DESE, 2016, p. 7).

5.4.2 Free Community College

On August 24, 2023, the Governor of Massachusetts, Maura T. Healey, announced a new program establishing free community college for MA residents aged 25 and older (mass.gov, 2023). Similar to the potential impact of removing MCAS scores as a graduation requirement, the introduction of free community college in Massachusetts may boost interest and participation in computer science, at least for those 25 years old and older.

According to the Massachusetts Association of Community Colleges (MASSCC), the state's 15 community colleges serve over 120,000 students (MASSCC, 2025), with six institutions currently offering associate degrees in CS.

Many of the state's community colleges offer associate degrees and certificates in computer science. These programs are designed either to prepare students for transfer to four-year institutions or to provide training for entry-level positions and specialized areas such as programming, networking, or cybersecurity. While some of these programs may focus more on information technology (IT) occupations, several community colleges in Massachusetts have established, well-regarded computer science offerings, including at Massachusetts Bay, Northern Essex, Middlesex, Cape Cod, and Bunker Hill Community Colleges.

Although the cost of higher education was not within the scope of this study, future research may be warranted to examine how removing financial barriers to advanced CS education could influence women's participation in the field. In the absence of empirical data, any claims remain speculative. However, the introduction of free community college for individuals aged 25 and older may help reduce access barriers to high-quality CS education and training.

5.4.3 Generative Artificial Intelligence (GAI)

Artificial Intelligence (AI) is not a novel concept; its theoretical foundations and practical applications have been evolving for decades. However, AI had not reached widespread public adoption until recently. In late 2022, OpenAI released ChatGPT, a conversational chatbot capable of generating content (e.g., text, images, and videos) in response to natural language prompts. ChatGPT's release marked a new era of in the advancement of AI technologies, unveiling what is now widely recognized as Generative AI (GenAI).

ChatGPT was developed using large language models (LLMs), which are trained on vast amounts of data gathered from mostly publicly accessible sources, including a wide range of internet content. These models are capable of processing massive volumes of information by categorizing data, identifying patterns, and making inferences. Technically speaking, LLMs can "learn" to perform various tasks by recognizing relationships within the data they are exposed to. In simpler terms, they acquire knowledge and skills through a process of data absorption and analytical pattern recognition.

Initially, users approached Generative AI (GenAI) tools similarly to traditional search engines, seeking explanations or suggestions in response to a wide range of queries. However, the use of GenAI quickly evolved, enabling individuals to generate “pseudo-original” content simply by typing in prompts. The term “pseudo” is used here deliberately, as large language models (LLMs) are trained on vast quantities of content, often without attribution and, at times, in ways that disregard copyright restrictions. This concern has been highlighted by the growing number of lawsuits filed by authors, news organizations, artists, and other content creators (Creamer, 2025; Grynbaum & Mac, 2023).

Generative AI (GenAI) has had a profound and far-reaching impact, with the education sector among the first to experience its effects. Students worldwide began leveraging GenAI to complete academic tasks such as writing essays, solving problems, and finishing assignments. In response, educational institutions across the globe, including K-12 schools to higher education, raised concerns about the potential for GenAI to foster superficial learning habits and diminish the development of critical thinking skills (Hadi Mogavi et al., 2024).

In parallel, businesses began adopting GenAI for productivity tasks, using it to draft emails, create reports, analyze data, and even generate computer code. Amongst GenAI’s many features, it can also produce code from simple, natural language prompts, speeding writing code as well as making it possible for non-programmers to develop software without prior coding knowledge.

This capacity is both empowering for individuals without backgrounds in computer science (CS) and potentially disruptive to those currently working in CS roles. While the full impact of GenAI tools is still emerging, some experts suggest that the proliferation of AI may contribute to shifts in the CS job market.

Jobs in the technology sector were undergoing a transformation prior to the widespread adoption of GenAI (Singer & Huang, 2022). In 2023, 264,220 technology employees were laid off from 1,193 tech companies (Lee, 2025). O'Brien (2025) argues that attributing recent layoffs to artificial intelligence (AI) is more of a "fashionable excuse," suggesting there might be other undisclosed factors. Shein (2025) points to both over-hiring during the pandemic and the increased automation made possible by AI as contributing factors. Layoffs have since declined; as of August 2025, 80,845 employees had been laid off from 176 technology companies (Lee, 2025).

The extent to which GenAI contributes to uncertainty in the technology job market appears to depend on the source (Shein, 2025). Some view GenAI as a job killer, automating tasks once requiring human expertise. Singer (2025) notes that securing entry-level software positions has become more difficult due to AI coding tools. Others argue that GenAI may foster innovation and create new roles. Farnsworth, Chief Technology Officer of technology job platform Dice, maintains that computer science degrees will remain in demand, noting, "Computer science graduates should not be concerned because the degree is well-compensated and there is still a demand for technologies" (p. 5).

In summary, it is too early to determine the full effects of GenAI on the CS job market, and most conclusions at this stage remain speculative. Nevertheless, GenAI has the potential to spark renewed interest in the field. While many individuals use GenAI tools daily, there will be a continued need for professionals to maintain, enhance, and innovate the systems that support them. Those involved in the development and improvement of GenAI, such as those that support large language models (LLMs), will still require to have solid computer science skills.

5.5 Limitations

As this study was descriptive rather than experimental, it cannot establish causal relationships between the presence, and quality, of SCCT curricular elements and students' decisions to pursue careers in specific fields. While SCCT has been validated as a framework for understanding how individuals develop career interest and motivation, its practical application within middle school CS curricula has yet to be empirically tested.

Another limitation of this study is the small sample size, which significantly affects the ability to draw robust conclusions from quantitative research questions, particularly Research Question 2 (RQ2). Based on the data collected, a Cohen's d of 0.232 would require approximately 293 participants per gender group (or a total of $\approx$ 586) to achieve 80% statistical power at an α level of 0.05. Even to detect a medium effect size ($d = 0.5$), the minimum required sample size would be approximately 64 participants per group (or $\approx$ 128 in total).

Beyond the quantitative aspects, the study would also have benefited from a more diverse sample in terms of school settings and student backgrounds. Incorporating a broader range of middle schools across Massachusetts, including different geographic regions, socioeconomic statuses, and educational contexts, would have enriched the qualitative data and provided a more comprehensive understanding of CS education courses and activities at the middle school level.

I also realized that modifying the CSMQ-II to use a 4-point Likert scale may have limited the range of response options available to participants. The original SMQ-II used a 5-point scale, and in retrospect, a broader scale, such as a 7-point Likert scale, might have captured greater variation in responses and provided more nuanced insights.

5.5.1 Site and Participant Recruitment Difficulties

Another limitation of this study is the small sample size of participating schools and individuals. Although the study did not explicitly aim to explore reasons for non-participation, it is likely that the ongoing effects of the COVID-19 pandemic and its associated stressors have impacted K–12 schools' willingness to engage in research. A 2024 report by RTI International (Carter et al., 2024) identified several key reasons why K–12 schools may decline participation in research studies. The most commonly cited reason (42%) was due to testing or other survey-related activities. Additional factors included concerns about student learning loss and reduced instructional time (8%), teacher shortages or turnover (8%), COVID-19-related issues (3%), and various non-COVID-19-related reasons (39%).

It is difficult to determine the precise reasons why, so few sites agreed to participate in this study. In conversations with administrators, some cited concerns about the time commitment required. Given the demanding schedules of school staff, it is understandable how participation in a research study could be perceived as an additional burden. Paradoxically, several teachers expressed a strong willingness to participate despite these concerns, only to be informed later that their administration had declined involvement, without providing a rationale.

Staff turnover may have also contributed to low participation. For instance, both the principal and the CS teacher at the one participating school left their positions before data collection was completed. Two other schools experienced changes in leadership during the recruitment phase, which disrupted communication, planning, and willingness to participate.

Some teachers speculated that schools may have been reluctant to participate due to the parent/guardian questionnaire component. Given the current political climate and heightened tensions between families and school boards, administrators may have been hesitant to engage in anything that may be construed as intrusive.

Finally, most schools and individuals did not respond at all to email outreach, raising the question of whether email is the most effective communication channel for engaging schools in research.

5.6 Future Research Recommendations

Identifying curricular elements that promote components of Social Cognitive Career Theory (SCCT) can guide future curriculum redesigns. Here are three suggestions for future research evaluating whether the presence and quality of SCCT curricular elements influence students' motivation and persistence in pursuing CS careers.

1. Large-scale, longitudinal studies. One potential approach to understanding students' evolving beliefs about career choices is to conduct a multi-year longitudinal study. Grounded in Social Cognitive Career Theory (SCCT), such a study could annually survey students to track changes in career goals, outcome expectations, and self-efficacy; either toward a specific career field or more broadly within STEM to allow for a wider lens. In parallel, curricular offerings

and other educational experiences could be documented to examine their influence on students' career beliefs over time.

This approach could draw inspiration from large-scale efforts led by the National Center for Education Statistics (NCES), such as: the *Educational Longitudinal Study of 2002 (ELS:2002)* (NCES, 2002), which followed students' transitions into the workforce; the *High School Longitudinal Study of 2009 (HSLS:09)* (NCES, 2009), which tracked 9th graders over time; and the *Middle Grades Longitudinal Study of 2017–18 (MGLS:2017)* (NCES, 2017), which focused on early adolescent development.

Such a study could offer deep insights into how students' career beliefs evolve and how targeted interventions or curricular reforms may shape those trajectories.

2. Cross-grade study. While multi-year longitudinal studies could offer rich insights, they are also resource-intensive to execute. An alternative is a cross-grade (or cross-sectional) study, which examines students at various academic stages to potentially explore how career interests evolve with age and exposure to career counseling. These one-time data collections can be done simultaneously across several grades, and are efficient, cost-effective, and can reveal developmental trends and age-related patterns in career exploration. Although they do not track individual change over time, cross-grade studies can inform the design of age-appropriate interventions. To implement such a study, collaboration with entire school districts would be necessary to gather responses across multiple grade levels. As with the longitudinal model, this approach could assess SCCT components related to a specific occupation or based on each student's career

interest. It could also help identify correlations between career development activities and the strength of students' career orientation.

Cross-grade and longitudinal studies examining students' career planning and exploration have been conducted. For example, Rogers and Creed (2011) investigated levels of self-efficacy, outcome expectations, career goals, perceived supports, and personality traits among Australian students in grades 10 through 12.

3. Intervention study. A third option could involve an experimental control group design using pre-, post-, and delayed post-assessments to evaluate students' motivation toward careers in computer science (CS) following targeted curricular changes. With Massachusetts residents voting to remove the Massachusetts Comprehensive Assessment System (MCAS) as a graduation requirement, school systems may soon have greater flexibility in how curricula are delivered. This change could either elevate the priority of CS and digital literacy in K–12 education, or further reduce the time and resources allocated to these areas.

   Using the SCCT-based rubric developed in this study, middle school educators and curriculum designers could introduce specific modifications aimed at enhancing students' self-efficacy, outcome expectations, and interest in CS. Pre-, post-, and delayed post-tests would allow researchers to measure short- and longer-term shifts in students' beliefs and motivations attributable to these interventions. Including a control group would also help determine whether the observed changes are due to the curricular modifications themselves. One example of an intervention-based pre/post study is Kovach (2018), who implemented a career development program at the middle school level and assessed its impact on students' self-efficacy, self-awareness, and alignment with long-term goals. Grounded in Social Cognitive Career Theory (SCCT), the study also incorporated value-affirmation interventions to give students opportunities to reflect on their career development experiences during this formative stage.

In addition, the SCCT rubric could be adapted for use in other subject areas to assess shifts in self-efficacy related to specific content or skills. Future research could also explore the duration and intensity of exposure required to foster meaningful changes in self-efficacy development.

APPENDICES

APPENDIX A: COMPUTER SCIENCE MOTIVATION QUESTIONNAIRE (CSMQ-II)

POZA, EMPOWERING GIRLS

Career Motivation and Computer Science Motivation Questionnaire (CSMQ-II)
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

How old are you? ___________________________

What's your race? ___________________________

What's your gender?
☐ Girl ☐ Boy ☐ Transgender ☐ Non-binary ☐ Prefer not to answer

I know you are in middle school, but you might have already thought about what you want to do after school, what your future career might be. Please note below what you want to be and why?

Please explain: ____

____

____

What do you enjoy doing the most during free time?

____

____

What do your parents/guardian(s) do for a living:

____

My parents/guardian(s) know exactly what I want to do for a living.
☐ No ☐ Yes ☐ It's complicated, here is why:

____

____

IRB OFFICE USE ONLY

1

My parents/guardian(s) think that when I grow up, I should be *(fill in the blank)*:

____

Do you agree with them?
☐ No ☐ Yes
Why? ____

____

In order to better understand what you think and how you feel about your computer science courses/activities, please respond to each of the following statements from the perspective of "When I am in a computer science course/activity…"

	NEVER	RARELY	OFTEN	ALWAYS
1. The computer science I learn is relevant to my life.				
2. I like to do better than other students on computer science tests/assignments.				
3. Learning computer science is interesting.				
4. Getting a good computer science grade is important to me.				
5. I put enough effort into learning computer science.				
6. I use strategies to learn computer science well.				
7. Learning computer science will help me get a good job.				
8. It is important that I get an "A" in computer science.				
9. I am confident I will do well on computer science tests/assignments.				
10. Knowing computer science will give me a career advantage.				
11. I spend a lot of time learning computer science.				
12. Learning computer science makes my life more meaningful.				
13. Understanding computer science will benefit me in my career.				

IRB OFFICE USE ONLY

	NEVER	RARELY	OFTEN	ALWAYS
14. I am confident I will do well on computer science labs and projects.				
15. I believe I can master computer science knowledge and skills.				
16. I prepare well for computer science tests/assignments and labs.				
17. I am curious about discoveries in computer science.				
18. I believe I can earn an "A" in computer science.				
19. I enjoy learning computer science.				
20. I think about the grade I will get in computer science.				
21. I am sure I can understand computer science.				
22. I study hard to learn computer science.				
23. My career will involve computer science.				
24. Scoring high on computer science tests/assignments and labs matters to me.				
25. I will use computer science problem-solving skills in my career.				

Anything else you'd like to share with us:

IRB OFFICE USE ONLY

3

APPENDIX B: PARENT/GUARDIAN QUESTIONNAIRE

POZA, EMPOWERING GIRLS

Parent/Guardian Survey
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

The following survey will help us gather an insight about your child's home environment and job/career prospects. Questions include demographics, your profession, and professions of your extended family. Your answers will help us list the different professions children are aware of, as well as what you as parent/care giver value when helping your child choose a potential career.

Gender of your middle school child:
☐ Girl ☐ Boy ☐ Transgender ☐ Non-binary ☐ Prefer not to answer

What is your race and/or ethnicity?
(select all that apply)

☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Hispanic or Latino
☐ Middle Easter or North African
☐ Native Hawaiian or Other Pacific Islander
☐ White

Level of education: HS, Some College, Bachelor's, Masters
☐ High School ☐ Some College ☐ Technical Degree/Certificate ☐ Bachelors ☐ Masters

Profession:

Spouse's/Partner's profession:

IRB OFFICE USE ONLY

1

Extended family's professions (name a few):

____

____

In your opinion, what profession your middle schooler child should pursue, and why?

____

____

Please rate the following statements:

	STRONGLY DISAGREE	DISAGREE	AGREE	STRONGLY AGREE
1. Salary is the most important thing when considering a job/career.				
2. My child is going to follow my footsteps.				
3. Being good at a particular field/discipline is important when considering a job/career.				
4. When it comes to choosing a career/profession, every person should follow their passion.				
5. Deciding a career, or path of study, is a joint parent/guardian and child decision.				
6. I support wholeheartedly my child's decision to embark on a career/field of study.				
7. My child is good with technology.				
8. A programmer (computer scientist) sits in front of a computer all the time.				
9. Most computer scientists/programmers are men.				
10. Math is not my child's strongest subject.				
11. I'm fully aware of what my child wants to do when she/he/they grow up				
12. Women are better suited for jobs like nurses and/or teachers.				

IRB OFFICE USE ONLY

Anything else you would like to add:

IRB OFFICE USE ONLY

APPENDIX C: STAFF QUESTIONNAIRE

Career and Computer Science Support for Middle School Students Survey
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

Thank you for agreeing to participate in this study. We are asking different staff with different roles to complete this survey, including staff that supports student success, including school counselors, administrators, and any other staff that interacts with students on a regular basis. There may be questions that do not apply to your current role.

What is your gender:
☐ Woman ☐ Men ☐ Transgender ☐ Non-binary ☐ Prefer not to answer

Are you Hispanic or Latino descent? (Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture)
☐ Yes ☐ No

Regardless of your answer to the prior question, please check *one or more* of the following groups in which you consider yourself to be a member:
☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Middle Eastern or North African
☐ Native Hawaiian or Other Pacific Islander
☐ White

Level of education:
☐ HS ☐ Technical Degree/Certificate ☐ Bachelors ☐ Masters ☐ Doctorate

What is your role at your school:

How would you describe current career counseling initiatives are your school?

IRB OFFICE USE ONLY

In your role, do you currently teach/facilitate sessions about career counseling?
☐ Yes ☐ No ☐ N/A
If Yes, please describe them:

In your role, do you have opportunities to discuss topics about career counseling with students?
☐ Yes ☐ No ☐ N/A
If Yes, please describe them:

In your role, are there opportunities for you to positively influence curriculum in ways that promote conversations about career counseling?
☐ Yes ☐ No ☐ N/A
If Yes, please describe how:

In your role, have you had opportunities to discuss with students traditionally gendered roles in careers/jobs? (For example, 87% of registered nurses in the U.S. are women; BLS, 2022)
☐ Yes ☐ No ☐ N/A
If Yes, please tell us more:

In your role, do you have opportunities to provide encouragement for girls to participate in traditionally male dominated courses/activities like computer science?
☐ Yes ☐ No ☐ N/A
If Yes, please tell us how (for example, enrollment quotas, etc.):

IRB OFFICE USE ONLY

What are your thoughts about college counseling at the middle school level?

In your opinion, what may be some positive ways to expand college counseling at the middle school level?

Anything else you would like to add:

IRB OFFICE USE ONLY

APPENDIX D: REVISED STAFF QUESTIONNAIRE

Career and Computer Science Support for Middle School Students Survey
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

Thank you for agreeing to participate in this study. We are asking different staff with different roles to complete this survey, including staff that supports student success, including school counselors, administrators, and any other staff that interacts with students on a regular basis. There may be questions that do not apply to your current role.

1) What is your gender:
☐ Woman ☐ Men ☐ Transgender ☐ Non-binary ☐ Prefer not to answer

2) Are you Hispanic or Latino descent? (Cuban, Mexican, Puerto Rican, South or Central American, or other Spanish culture)
☐ Yes ☐ No

3) Regardless of your answer to the prior question, please check *one or more* of the following groups in which you consider yourself to be a member:
☐ American Indian or Alaska Native
☐ Asian
☐ Black or African American
☐ Middle Eastern or North African
☐ Native Hawaiian or Other Pacific Islander
☐ White

4) Level of education:
☐ HS ☐ Technical Degree/Certificate ☐ Bachelors ☐ Masters ☐ Doctorate

5) Is your school public or private?
☐ Public ☐Private

6) What is your role at your school:
☐Computer Science Teacher* ☐Other Teacher ☐School Counselor ☐Administrator
☐Other_______

7) Is Computer Science (CS) an elective or required course?
☐Elective*** ☐Required

IRB OFFICE USE ONLY

***If the course is an elective, are students encouraged to enroll in CS courses? If so, how are they encouraged?

---

8) * What type of CS curriculum does your school use? Is it a custom-developed curriculum, a third-party resource (such as Code.org), or a combination of both? Please describe.

---

9) * Can you describe the key topics/units covered in your CS curriculum?

---

10) *Can you provide descriptions of the assignments included in your CS curriculum?

---

11) How would you describe current career counseling initiatives are your school?

---

12) In your role, do you currently teach/facilitate sessions about career counseling?
☐ Yes ☐ No ☐ N/A
If Yes, please describe them:

---

13) In your role, do you have opportunities to discuss topics about career counseling with students?
☐ Yes ☐ No ☐ N/A
If Yes, please describe them:

IRB OFFICE USE ONLY

14) In your role, are there opportunities for you to positively influence curriculum in ways that promote conversations about career counseling?
☐ Yes ☐ No ☐ N/A
If Yes, please describe how:

---

15) In your role, have you had opportunities to discuss with students traditionally gendered roles in careers/jobs? (For example, 87% of registered nurses in the U.S. are women; BLS, 2022)
☐ Yes ☐ No ☐ N/A
If Yes, please tell us more:

---

16) In your role, do you have opportunities to provide encouragement for girls to participate in traditionally male dominated courses/activities like computer science?
☐ Yes ☐ No ☐ N/A
If Yes, please tell us how (for example, enrollment quotas, etc.):

---

17) What are your thoughts about college counseling at the middle school level?

---

18) In your opinion, what may be some positive ways to expand college counseling at the middle school level?

---

19) Anything else you would like to add:

** Questions only available for those choosing computer science teacher as a role.*

IRB OFFICE USE ONLY

3

APPENDIX E: STUDENT ASSENT FORM

Assent Form for Participation in a Research Study
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

---

1. WHAT IS A RESEARCH STUDY?

A research study is a way to find out new information about something. You do not need to be in a research study if you don't want to.

2. WHY ARE YOU BEING ASKED TO BE PART OF THIS RESEARCH STUDY?

You are being asked to take part in this research study because we are trying to learn more about how students like you choose a career. We are inviting you to be in the study because we believe middle school is a great time to start thinking about what profession you'd like to have.

3. IF YOU JOIN THE STUDY WHAT WILL YOU BE ASKED TO DO?

- Participation in this study will consist of 1) attending and participating in a presentation titled "Choosing a Career"; and 2) completing a survey that includes demographic questions (for example: age, gender, parents/caregiver professions), what your career goals and expectations are, and about what you think and feel about computer science.
- The entire study will take place during one of your classes.

4. HOW WILL BEING IN THIS STUDY AFFECT ME?

- We want to know more about what students like/dislike about their computer science class, or what activities are interesting and encourage participation. We are also interested about your future career plans. Have you been thinking about a future career, and if you do what that might be? It is important for you to know that there is no right or wrong answer.
- Participating in this study will provide you with an overview of what computer science is, and what type of jobs you could land as a computer scientist.
- With this study we hope to find ways for people like you to be able to choose a career that is fulfilling and that you'll enjoy doing.

5. DO YOUR PARENT(S)/GUARDIAN(S) KNOW ABOUT THIS STUDY?

Your parent(s)/guardian(s) knows we are going to ask you to participate in a project on learning about computer science. This study was explained to your parents, and they said that they agree with your participation as long as you want to be in the study.

6. WHO WILL SEE THE INFORMATION COLLECTED ABOUT YOU?

- The information collected about you during this study will be kept safely locked up. Nobody will know it except the people doing the research. In addition, all information we collect will be anonymous, in other words, your name will not be attached to your responses.

IRB OFFICE USE ONLY

University of Massachusetts Amherst-IRB:
Kuali #: 4973
IRB Signature:

1

- The study information about you will not be shared with your parents or parents individually, but rather as a group (for example: 20% of students stated that are very interested in pursuing a career in computer science.

7. WHAT DO YOU GET FOR BEING IN THE STUDY?
Participating in this study will provide you with an overview of what a career in computer science may look like, as well as give you tools for considering other careers.

8. DO YOU HAVE TO BE IN THE STUDY?
- You do not have to be in the study. No one will be upset if you don't want to do this study. If you don't want to be in this study, you just have to tell us. It's up to you.
- You can also take more time to think about being in the study.

9. WHAT IF YOU HAVE ANY QUESTIONS?
- You can ask any questions that you may have about the study. If you have a question later that you didn't think of now, you can call or text Ricardo Poza (617) 777-5204.
- You can also take more time to think about being in the study and also talk some more with your parents/guardians about being in the study.
- If you have any concerns about your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu.

10. OTHER INFORMATION ABOUT THE STUDY:
- If you decide to be in the study, please write your name below.
- You can change your mind and stop being part of it at any time. All you have to do is tell the person in charge. It's okay.
- You will be given a copy of this paper to keep.

If you want to be in this study, please sign your name below.

Signature ____ Date__________________

Participant Name____ Date__________________

School ____ Class _____________________

Name of Person obtaining consent ____________________________ Date__________________

IRB OFFICE USE ONLY

University of Massachusetts Amherst-IRB:
Kuali #: 4373
IRB Signature:

2

APPENDIX F: PARENT/GUARDIAN CONSENT FORM

Informed Consent Form for Participation in a Research Study
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

---

1. **WHAT IS THIS FORM?**

This form is called a Consent Form. It will give you information about the study so you can make an informed decision about participation in this research. We encourage you to take some time to think this over and ask questions now and at any other time. If you decide to participate, you will be asked to sign this form and you will be given a copy for your records.

2. **WHAT ARE SOME OF THE IMPORTANT ASPECTS OF THIS RESEARCH STUDY THAT I SHOULD BE AWARE OF?**

Both you and your child's participation in this study is voluntary. Participation, or choosing not to participate, in this study will not affect any of your child's middle school grades.

3. **WHO IS ELEGIBLE TO PARTICIPATE?**

Any students at your child's school and their parents/guardians are eligible to participate in this study, including students of any age currently taking middle school computer science courses, students of any gender, any ethnic or racial background, and students with any learning disabilities, health diagnosis, or treatment plans.

4. **WHY ARE WE DOING THIS RESEARCH STUDY?**

The purpose of the research is to examine middle school students career goals and expectations, and to ascertain if they would consider computer science as a potential career choice. I hope this research will help figure out ways to promote different career choices for children in middle school.

5. **WHERE WILL THE STUDY TAKE PLACE AND HOW LONG WILL IT LAST?**

The entire study will take place at your child's school during a computer science, or science course/activity. We anticipate collecting data during a one (1) hour period. During that hour you child will attend and participate in a presentation titled "Choosing a Career" and complete a questionnaire.

6. **WHAT WILL I BE ASKED TO DO?**

If you consent to your child's participation in the study, your child will participate in a talk and discussion about careers (Choosing a Career) with an emphasis on computer science. The presentation will consist of an overview of the process of choosing a career (goals, expectations, current/previous experiences), special emphasis will be given to computer science; highlighting the salary of a computer scientist and potential jobs a computer scientists may perform. In addition, your child will complete a questionnaire that includes

IRB OFFICE USE ONLY
University of Massachusetts Amherst-IRB:
Kuali #: 4973
IRB Signature:

questions about demographics (age, ethnicity, gender), how she/he thinks and feels about computer science, as well as general career prospects. As a parent/guardian you will also be asked to complete a questionnaire that includes questions about demographics, your occupation, as well as a series of questions related to your child's potential career choices.

7. WHAT ARE MY BENEFITS OF BEING IN THIS STUDY?

While there may be no direct benefits, the potential benefits for the participants of this study are to gain an awareness of possible future careers in the field of computer science. It could also start a conversation between you and your child about future career prospects.

8. WHAT ARE MY RISKS OF BEING IN THIS STUDY?

I believe there are no known risks associated with this research study, however, there is always a risk of breach of confidentiality, but this has been mitigated as described below in section 9.

9. HOW WILL MY PERSONAL INFORMATION BE PROTECTED?

The following procedures will be used to protect the confidentiality of your and your child's study information. Your child's identity as a participant in this research project will be kept anonymous. Every eligible student at your child's school will be given a Consent Form (this form) for her/his parents/guardians. If you agree to your child's participation in the study, then please return this form signed as well as the parent questionnaire. We will also ask your child whether they want to participate in the study (assent form). All data collected (questionnaire, participation in presentation) will be collected in a deidentified manner. An alphanumeric code will be used to match parent/guardian and child responses. The primary researcher (Ricardo Poza) will keep all study records, including questionnaires and any other data collected during discussions, in a secure, locked file in his university office. All forms will be digitized and kept within a password protected environment. Only the researcher will have access to the study's data.

At the conclusion of this study, the researchers may publish their findings. Information will be presented in summary format and you, or your child, will not be identified in any publications or presentations.

10. WILL I BE GIVEN ANY MONEY OR OTHER COMPENSATION FOR BEING IN THIS RESEARCH STUDY?

Participation in this research is voluntary, without monetary compensation. It is our hope that participating in this study will foster conversations with your child/guardian about choosing a career.

11. WHO CAN I TALK TO IF I HAVE QUESTIONS?

I am happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related concern, you may contact the researcher, Ricardo Poza (617) 777-5204 rpoza@umass.edu or the faculty advisor Martina Nieswandt, Vice President for Research and Graduate Education – Chapman University mnieswan@umass.edu. In addition, you may contact your child's computer science teacher.

IRB OFFICE USE ONLY

University of Massachusetts Amherst-IRB:
Kuali #: 4973
IRB Signature:

2

If you have any questions concerning your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu

12. WHAT HAPPENS IF I SAY YES, BUT I CHANGE MY MIND LATER?
You do not have to sign you or your child up to be in this study if you do not want to. If you agree to have your child participate in the study, but later change your mind, you may opt your child out at any time. There are no penalties or consequences of any kind if you decide that you do not want your child to participate.

13. WHAT IF I AM INJURED
The University of Massachusetts does not have a program for compensating subjects for injury or complications related to human subjects' research, but the study personnel will assist you in getting treatment according to the school's procedures.

14. SUBJECT STATEMENT OF VOLUNTARY CONSENT
When signing this form, I am agreeing to voluntarily enter my child and myself into this study. I have had a chance to read this consent form, and it was explained to me in a language which I use and understand. I have had the opportunity to ask questions and have received satisfactory answers. I understand that I can withdraw my child at any time. A copy of this signed Informed Consent Form has been given to me.

____________________	________________________	____/____/___
Participant Signature:	Print Name:	Date:

By signing below, I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

____________________	________________________	____/____/___
Participant Signature: Obtaining Consent	Print Name:	Date:

IRB OFFICE USE ONLY
University of Massachusetts Amherst-IRB:
Kuali #: 4973
IRB Signature:

APPENDIX G: INITIAL STAFF CONSENT FORM

Informed Consent Form for Participation in a Research Study
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

---

1. **WHAT IS THIS FORM?**
This form is called a Consent Form. It will give you information about the study so you can make an informed decision about participation in this research. We encourage you to take some time to think this over and ask questions now and at any other time. If you decide to participate, you will be asked to sign this form and you will be given a copy for your records.

2. **WHAT ARE SOME OF THE IMPORTANT ASPECTS OF THIS RESEARCH STUDY THAT I SHOULD BE AWARE OF?**
Your participation in this study is voluntary. Participation, or choosing not to participate, in this study will have no effect to your employment status.

3. **WHO IS ELEGIBLE TO PARTICIPATE?**
Any staff member at your school is eligible to participate in this study, including, but not limited to, teachers, school counselors, administrators willing to participate regardless of gender, age, ethnic or racial background.

4. **WHY ARE WE DOING THIS RESEARCH STUDY?**
The purpose of the research is to examine middle school students career goals and expectations, and to ascertain if they would consider computer science as a potential career choice. I hope this research will help figure out ways to promote different career choices for children in middle school.

5. **WHERE WILL THE STUDY TAKE PLACE AND HOW LONG WILL IT LAST?**
The entire study will take place at your school. Students attending computer science classes will participate in a presentation/discussion titled "Choosing a Career" and complete a questionnaire. Staff members will be asked to complete an online questionnaire.

6. **WHAT WILL I BE ASKED TO DO?**
If you consent to participate in this study, you will be asked to complete a short questionnaire. Completing the questionnaire should take you about 10 minutes to complete.

7. **WHAT ARE MY BENEFITS OF BEING IN THIS STUDY?**
There may not be potential benefits for student participants of this study. Although a potential benefit is for students to gain an awareness of possible future careers in the field of computer science. Once the study has been completed, all results will be shared with your school school in written form and/or faculty development sessions.

IRB OFFICE USE ONLY
University of Massachusetts Amherst-IRB:
Kuali #: 4973
IRB Signature:

8. WHAT ARE MY RISKS OF BEING IN THIS STUDY?

I believe there are no known risks associated with this research study, however, a possible inconvenience may be the time it takes to complete the questionnaire. In addition, there is always a risk of breach of confidentiality although this has been mitigated as described below in section 9.

9. HOW WILL MY PERSONAL INFORMATION BE PROTECTED?

The following procedures will be used to protect the confidentiality of your questionnaire responses. Each willing participant will receive a weblink to this form (consent form), due to legal procedures, full names must be collected while securing your consent to participate. If you choose to participate in the study, you will receive a second weblink where you can complete the questionnaire. Participation in the questionnaire will be kept anonymous and your name will not be collected. All submissions will be collected electronically and kept within a password protected environment. Only the researcher will have access to the study's data.

At the conclusion of this study, the researchers may publish their findings. Information will be presented in summary format so your information will not be identified in any publications or presentations.

10. WILL I BE GIVEN ANY MONEY OR OTHER COMPENSATION FOR BEING IN THIS RESEARCH STUDY?

Participation in this research is voluntary, without monetary compensation.

11. WHO CAN I TALK TO IF I HAVE QUESTIONS?

I am happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related concern, you may contact the researcher, Ricardo Poza (617) 777-5204 rpoza@umass.edu or the faculty advisor Martina Nieswandt, Vice President for Research and Graduate Education – Chapman University mnieswan@umass.edu. If you have any questions concerning your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu

12. WHAT HAPPENS IF I SAY YES, BUT I CHANGE MY MIND LATER?

You do not have to participate in this study if you do not want to. If you agree to participate in the study, but later change your mind, you may opt out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.

13. WHAT IF I AM INJURED

The University of Massachusetts does not have a program for compensating subjects for injury or complications related to human subjects' research, but the study personnel will assist you in getting treatment according to your school's procedures.

IRB OFFICE USE ONLY

University of Massachusetts Amherst-IRB:
Kuali #: 4973
IRB Signature:

2

14. SUBJECT STATEMENT OF VOLUNTARY CONSENT

When signing this form, I am agreeing to voluntarily participate in this study. I have had a chance to read this consent form, and it was explained to me in a language which I use and understand. I have had the opportunity to ask questions and have received satisfactory answers. I understand that I can withdraw from participating at any time. A copy of this signed Informed Consent Form has been given to me.

______________________	__________________________	____/____/___
Participant Signature:	Print Name:	Date:

By signing below, I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

______________________	__________________________	____/____/___
Participant Signature: Obtaining Consent	Print Name:	Date:

IRB OFFICE USE ONLY

University of Massachusetts Amherst-IRB:

Kuali #: 4073

IRB Signature:

3

APPENDIX H: REVISED STAFF CONSENT FORM

Informed Consent Form for Participation in a Research Study
University of Massachusetts Amherst

Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

My name is Ricardo Poza, and I am a doctoral student at the University of Massachusetts Amherst, College of Education. As part of my research, I am investigating factors that may motivate middle school students to consider or pursue specific careers. Specifically, I am exploring student interest in computer science (CS) and whether certain curricular elements support or encourage girls and boys to consider careers in CS.

Through this study, I hope to gain insights into what motivates students to explore CS careers, or what barriers may discourage them from doing so. Your participation will help us better understand how middle schools support students as they begin thinking about what they want to be when they grow up.

If you choose to participate, you will be asked to complete this consent form (including your signature at the bottom and email address) and a brief questionnaire. To maintain confidentiality, once you submit the consent form, you will receive a link to complete the questionnaire.

We request your email address for two reasons: 1) to send you a copy of your completed consent form for your records; and 2) to provide you with a $5 Dunkin' gift card as a token of appreciation for your time and participation.

Thank you for your consideration. Your insights are invaluable to this research.

Thank you,
Ricardo Poza
rpoza@umass.edu

Please review the following before agreeing/disagreeing to participate in this study:

---

1. **WHAT IS THIS FORM?**
This form is called a Consent Form. It will give you information about the study so you can make an informed decision about participation in this research. We encourage you to take some time to think this over and ask questions now and at any other time. If you decide to participate, you will be asked to sign this form and you will be given a copy for your records.

IRB OFFICE USE ONLY

2. **WHAT ARE SOME OF THE IMPORTANT ASPECTS OF THIS RESEARCH STUDY THAT I SHOULD BE AWARE OF?**

Your participation in this study is voluntary and confidential.

3. **WHO IS ELEGIBLE TO PARTICIPATE?**

Any middle school staff member is eligible to participate in this study, including, but not limited to, teachers, school counselors, administrators willing to participate regardless of gender, age, ethnic or racial background.

4. **WHY ARE WE DOING THIS RESEARCH STUDY?**

The purpose of this study is to examine CS curricula and related support services that may encourage student participation in CS courses and activities, ultimately increasing the likelihood of continued engagement in CS throughout high school and beyond.

5. **WHERE WILL THE STUDY TAKE PLACE AND HOW LONG WILL IT LAST?**

A complete dataset has already been collected from a participating middle school. Your insights will be aggregated to help establish a baseline understanding of CS curricula and support services in Massachusetts middle schools. Your participation will be limited to completing the attached questionnaire, with no further involvement required.

6. **WHAT WILL I BE ASKED TO DO?**

If you consent to participate in this study, you will be asked to complete a short questionnaire. Completing the questionnaire should take you about 10 minutes to complete.

7. **WHAT ARE MY BENEFITS OF BEING IN THIS STUDY?**

While there may not be direct benefits to you for participating in this study, a potential benefit is gaining insight into how middle school students, both girls and boys, are motivated and supported in computer science (CS) courses and activities. Additionally, this study aims to explore whether career counseling conversations take place at the middle school level.

8. **WHAT ARE MY RISKS OF BEING IN THIS STUDY?**

I believe there are no known risks associated with this research study, however, a possible inconvenience may be the time it takes to complete the questionnaire. In addition, there is always a risk of breach of confidentiality although this has been mitigated as described below in section 9.

9. **HOW WILL MY PERSONAL INFORMATION BE PROTECTED?**

The following procedures will be used to ensure the confidentiality of your questionnaire responses. Each participant will receive a secure weblink to this consent form. Full names must be collected as part of the consent process but will not be tied to your questionnaire's responses.

If you choose to participate in the study, the first step is to sign this consent form. Once you have completed the form, you will receive a separate link to access the questionnaire. **Your**

IRB OFFICE USE ONLY

responses to the questionnaire will remain deidentified, and your name will not be collected.

All submissions will be stored electronically in a secure, password-protected environment. Only the researcher will have access to the study data.

At the conclusion of the study, findings may be published or presented. However, all data will be reported in summary format, ensuring that no identifying information is disclosed in any publications or presentations.

10. WILL I BE GIVEN ANY MONEY OR OTHER COMPENSATION FOR BEING IN THIS RESEARCH STUDY?
Participation in this research is entirely voluntary. As a token of appreciation for your time, you will receive a $5 Dunkin' gift card via email.

11. WHO CAN I TALK TO IF I HAVE QUESTIONS?
I am happy to answer any questions you have about this study. If you have further questions about this project or if you have a research-related concern, you may contact the researcher, Ricardo Poza (617) 777-5204 rpoza@umass.edu or the faculty advisor Martina Nieswandt, Vice President for Research and Graduate Education – Chapman University mnieswan@umass.edu. If you have any questions concerning your rights as a research subject, you may contact the University of Massachusetts Amherst Human Research Protection Office (HRPO) at (413) 545-3428 or humansubjects@ora.umass.edu

12. WHAT HAPPENS IF I SAY YES, BUT I CHANGE MY MIND LATER?
You do not have to participate in this study if you do not want to. If you agree to participate in the study, but later change your mind, you may opt out at any time. There are no penalties or consequences of any kind if you decide that you do not want to participate.

13. WHAT IF I AM INJURED
The University of Massachusetts does not have a program for compensating subjects for injury or complications related to human subjects' research, but the study personnel will assist you in getting treatment according to your school's procedures.

14. SUBJECT STATEMENT OF VOLUNTARY CONSENT
When signing this form, I am agreeing to voluntarily participate in this study. I have had a chance to read this consent form, and it was explained to me in a language which I use and understand. I have had the opportunity to ask questions and have received satisfactory answers. I understand that I can withdraw from participating at any time. A copy of this signed Informed Consent Form has been given to me.

____________________ ________________________ ____/____/___

IRB OFFICE USE ONLY

3

Participant Signature: Print Name: Date:

By signing below, I indicate that the participant has read and, to the best of my knowledge, understands the details contained in this document and has been given a copy.

____________________	________________________	____/____/___
Participant Signature: Obtaining Consent	Print Name:	Date:

Email address *(email will only be used to send you a copy of your completed consent form and for gift card distribution)*: ___________________

IRB OFFICE USE ONLY

APPENDIX I: IRB APPROVAL LETTER

UMassAmherst

Human Research Protection Office

Mass Venture Center
100 Venture Way, Suite 116
Hadley, MA 01035
Telephone: 413-545-3428

Date: May 24, 2024
To: Professor Martina Nieswandt and Ricardo Poza, College of Education
From: Professor Lynnette Leidy Sievert, Chair, University of Massachusetts Amherst IRB

Protocol Title: *Empowering Girls to Have a Choice: Investigating How Social Cognitive Career Theory Can Inform Middle School Computer Science Curriculums*
Protocol ID: 4973
Review Type: Expedited – NEW
Category: 6,7
Approval Date: 05/24/2024
Award #:
No Continuing Review Required

This study has been reviewed and approved by the University of Massachusetts Amherst IRB, Federal Wide Assurance # 00003909. Approval is granted with the understanding that investigator(s) are responsible for:

Consent forms - A copy of the approved consent form (with the IRB stamp) must be used for each participant (Please note: Online consent forms will not be stamped). Investigators must retain copies of signed consent forms for six (6) years after close of the grant, or three (3) years if unfunded.

Use only IRB-approved study materials (e.g., questionnaires, letters, advertisements, flyers, scripts, etc.) in your research.

Revisions - All changes to the study (e.g. protocol, recruitment materials, consent form, additional key personnel), must be submitted for approval in e-protocol before implementing the changes. New personnel must have completed CITI training.

Final Reports - Notify the IRB when your study is complete by submitting a Close Request Form in the electronic protocol system.

Serious Adverse Events and Unanticipated problems involving risks to participants or others - All such events must be reported in the electronic protocol system as soon as possible, but no later than five (5) working days.

Annual Check In - HRPO will conduct an annual check in to determine the study status.

Please contact the Human Research Protection Office if you have any further questions. Best wishes for a successful project.

APPENDIX J: IRB APPROVAL AMMENDMENT LETTER

UMassAmherst

Human Research Protection Office

Mass Venture Center
100 Venture Way, Suite 116
Hadley, MA 01035
Telephone: 413-545-3428

Date: February 27, 2025
To: Professor Martina Nieswandt and Ricardo Poza, College of Education
From: Professor Lynnette Leidy Sievert, Chair, University of Massachusetts Amherst IRB

Protocol Title: *Empowering Girls to Have a Choice: Investigating How Social Cognitive Career Theory Can Inform Middle School Computer Science Curriculums.*
Protocol ID: 4973
Review Type: Expedited – Amendment
Approval Date: 02/27/2025
No Continuing Review Required

This study has been reviewed and approved by the University of Massachusetts Amherst IRB, Federal Wide Assurance # 00003909. Approval is granted with the understanding that investigator(s) are responsible for:

Consent forms - A copy of the approved consent form (with the IRB stamp) must be used for each participant (Please note: Online consent forms will not be stamped). Investigators must retain copies of signed consent forms for six (6) years after close of the grant, or three (3) years if unfunded.

Use only IRB-approved study materials (e.g., questionnaires, letters, advertisements, flyers, scripts, etc.) in your research.

Revisions - All changes to the study (e.g. protocol, recruitment materials, consent form, additional key personnel), must be submitted for approval in e-protocol before implementing the changes. New personnel must have completed CITI training.

Final Reports - Notify the IRB when your study is complete by submitting a Close Request Form in the electronic protocol system.

Serious Adverse Events and Unanticipated problems involving risks to participants or others - All such events must be reported in the electronic protocol system as soon as possible, but no later than five (5) working days.

Annual Check In - HRPO will conduct an annual check in to determine the study status.

Please contact the Human Research Protection Office if you have any further questions. Best wishes for a successful project.

APPENDIX K: "CHOOSING A CAREER" PRESENTATION/DISCUSSION OUTLINE

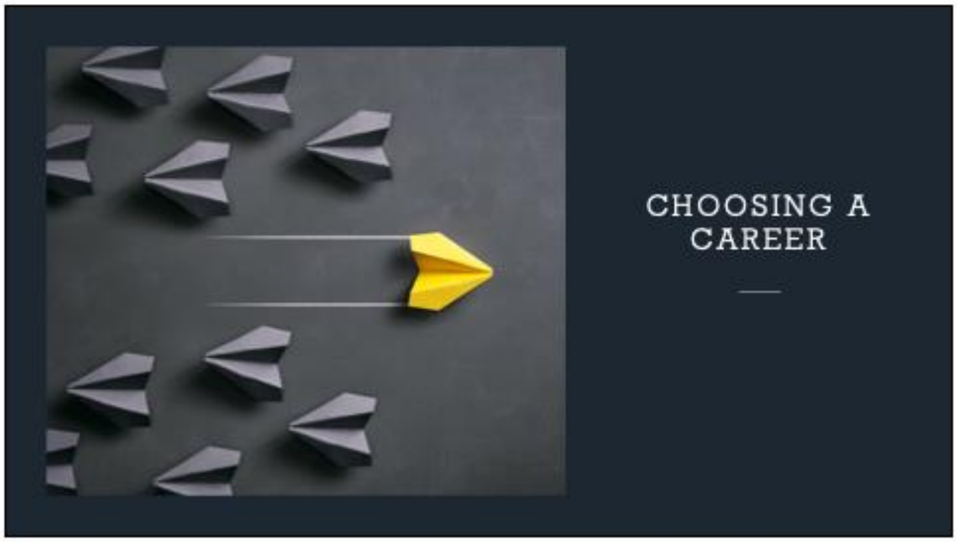
POZA, EMPOWERING GIRLS

"Choosing a Career" Presentation/Discussion Outline

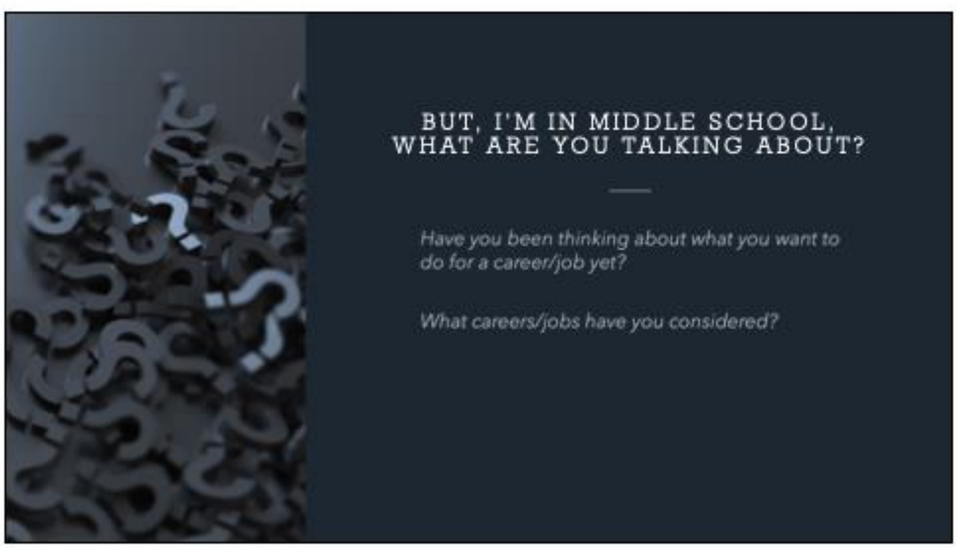
Researcher(s): Ricardo Poza
Study Title: Empowering Girls to Have a Choice

- But, I'm in middle school, what are you talking about?
    - Prompt: have you been thinking about what do you want to do for a career/job yet?
    - Prompt: what careers/jobs have you considered?
- 10 most common professions
- What is computer science?
- What do computer scientists do?
    - Prompt: What do a computer scientist look like?
- Computer Science at glance
    - Things you'll do as a computer scientist
    - What much money do computer scientists make?
- Things to consider when choosing a career (SCCT primer):
    - Goals
        - When I grow up I want to be an artist, make art… A salesperson, a politician
    - Outcome expectations
        - I expect to be doing this, from where, at what time, with a salary of…
    - Self-efficacy sources
        - What type of experiences have I had in this particular area, can I try it?
        - Do I see myself represented? Do I know of anybody that does this job/career for a living?
        - Have you tell anybody about your future career/jobs plans? Who are they? And what do they have to say about it?
        - How does the prospect of choosing a career/job makes you feel? Am I excited, happy, nervous?

APPENDIX L: "CHOOSING A CAREER" PRESENTATION SLIDES



1



2


10 MOST POPULAR PROFESSIONS
indeed
1. Cashier
2. Food Preparation Worker
3. Stocking Associate
4. Laborer
5. Janitor
6. Construction Worker
7. Bookkeeper
8. Server
9. Medical Assistant
10. Bartender

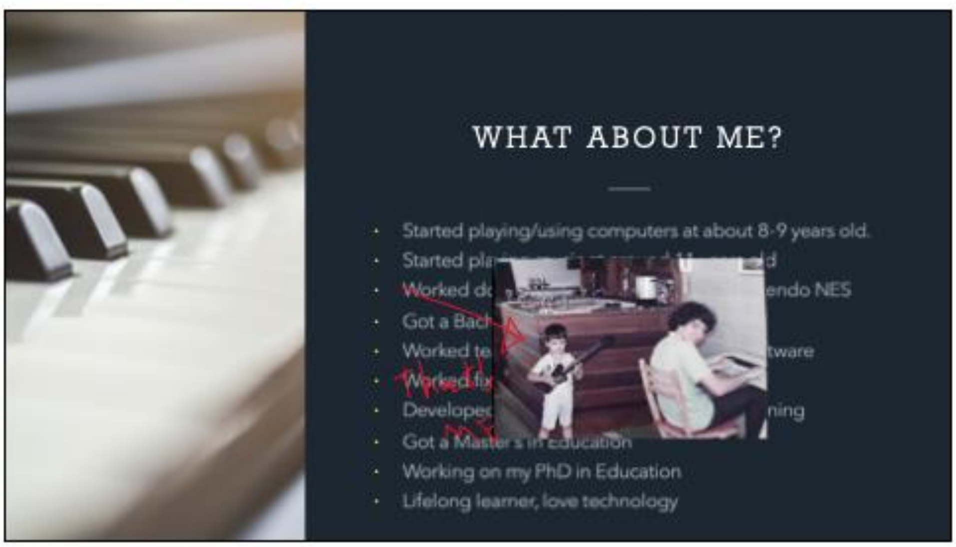
3


WHAT ARE THE MOST IMPORTANT THINGS TO YOU WHEN CONSIDERING A CAREER
Salary
1. Cashier $24K
2. Food Preparation Worker $31K
3. Stocking Associate $27K
4. Laborer $45K
5. Janitor $39K
6. Construction Worker $49K
7. Bookkeeper $50K
8. Server $32K + tips
9. Medical Assistant $36K
10. Bartender $39K + tips
Would I like doing this?
Is it part of my master plan (goal)?
Do I see myself doing this?

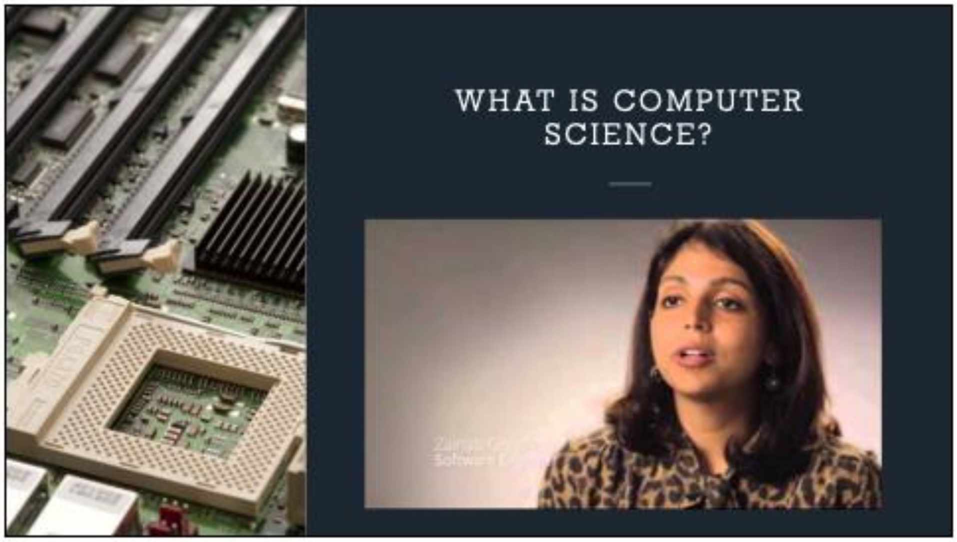
4


THINGS TO CONSIDER WHEN CHOOSING A CAREER
Experiences, Perceptions, Support, Feelings
+
Goals
When I grow up I want to be an artist, make art… Be a salesperson, a politician
+
Outcome Expectations
I expect to be doing this, from where, at what time, with a salary of…

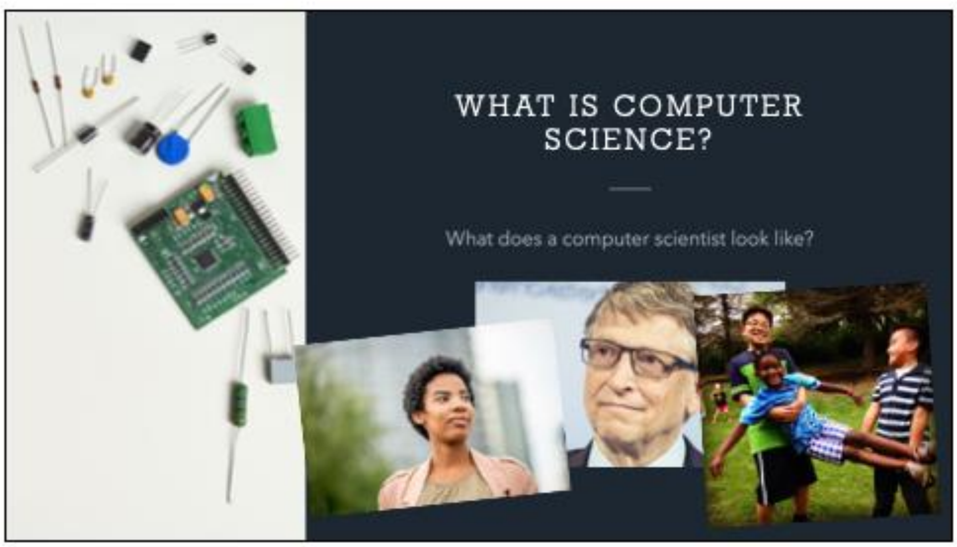
5


WHAT ABOUT ME?
Started playing/using computers at about 8-9 years old.
Started pla
Worked d
endo NES
Got a Bac
Worked te
tware
Worked fi
Develope
ning
Got a Master's in Education
Working on my PhD in Education
Lifelong learner, love technology

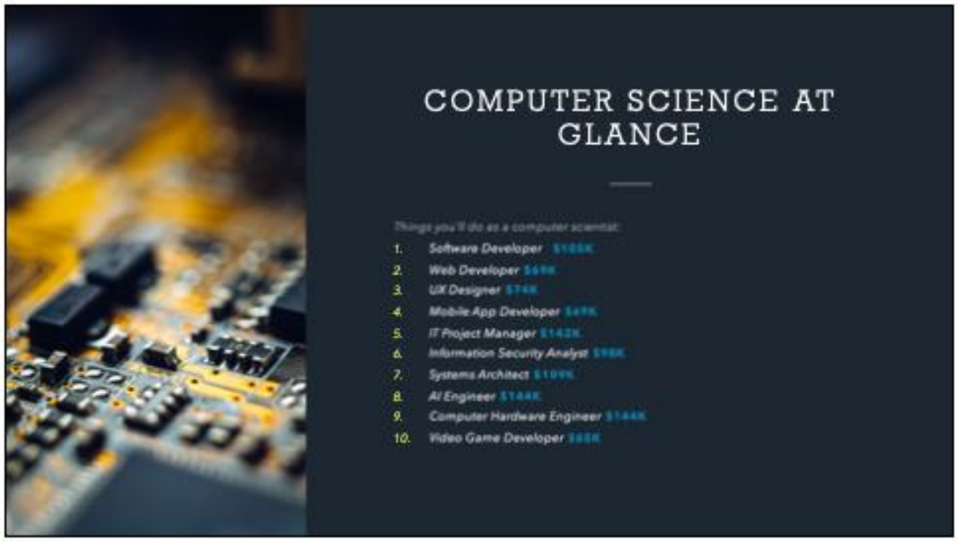
6


WHAT IS COMPUTER SCIENCE?

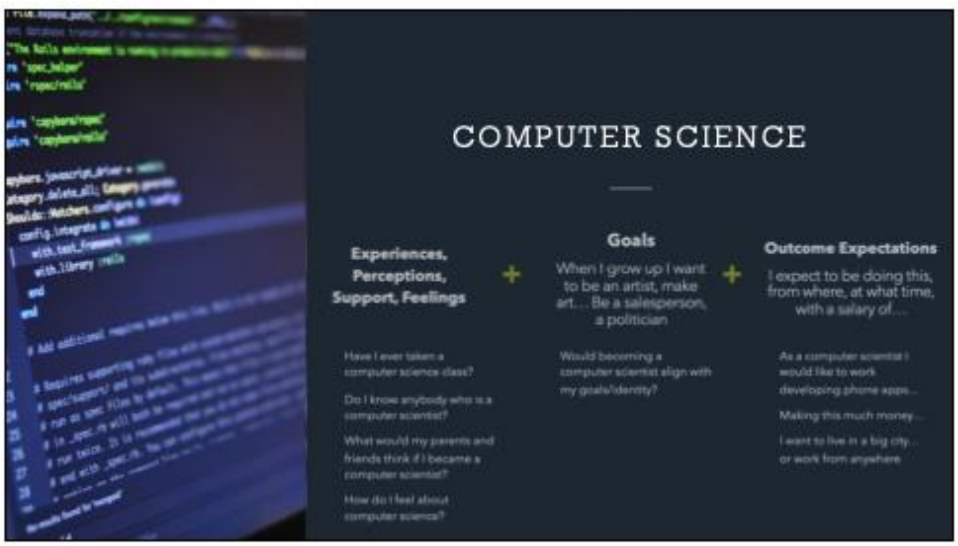
7


WHAT IS COMPUTER SCIENCE?
What does a computer scientist look like?

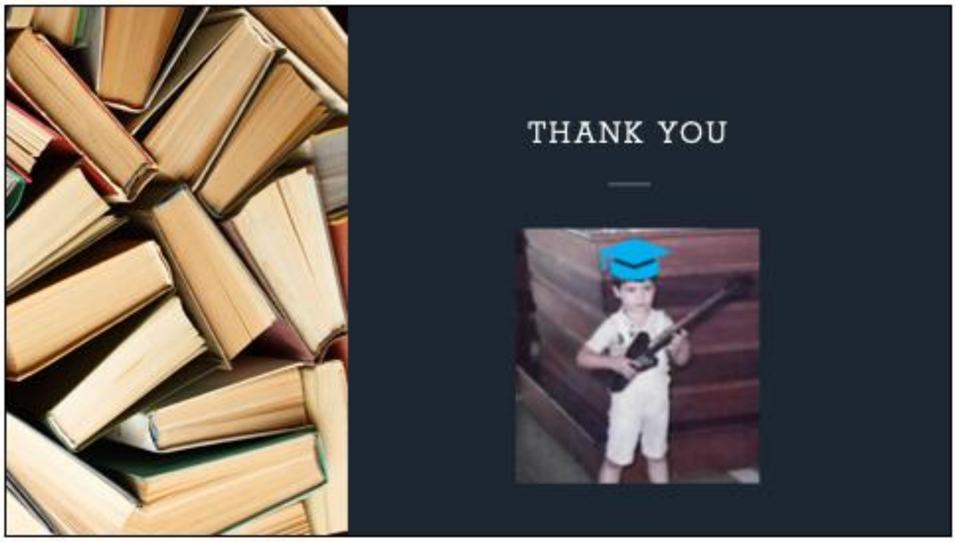
8


COMPUTER SCIENCE AT GLANCE
Things you'll do as a computer scientist:
1. Software Developer
2. Web Developer
3. UX Designer
4. Mobile App Developer
5. IT Project Manager
6. Information Security Analyst
7. Systems Architect
8. AI Engineer
9. Computer Hardware Engineer
10. Video Game Developer

9


COMPUTER SCIENCE
Experiences, Perceptions, Support, Feelings
+
Goals
When I grow up I want to be an artist, make art… Be a salesperson, a politician
+
Outcome Expectations
I expect to be doing this, from where, at what time, with a salary of…
Have I ever taken a computer science class?
Do I know anybody who is a computer scientist?
What would my parents and friends think if I became a computer scientist?
How do I feel about computer science?
Would becoming a computer scientist align with my goals/identity?
As a computer scientist I would like to work developing phone apps…
Making this much money…
I want to live in a big city… or work from anywhere

10



11

BIBLIOGRAPHY

Abdul Rahaman, W., Mohammed, I., Turkson, F. E., & Baffour, P. T. (2023). Influences of parental occupation on children's occupational choices. *International Journal of Social Economics*, *50*(12), 1735-1755. https://doi.org/10.1108/IJSE-10-2022-0705

ACTE. (2017). *Career Exploration in Middle School: Setting Students on the Path to Success*. https://www.acteonline.org/wp-content/uploads/2018/02/ACTE_CC_Paper_FINAL.pdf

Akosah-Twumasi, P., Emeto, T. I., Lindsay, D., Tsey, K., & Malau-Aduli, B. S. (2018). A systematic review of factors that influence youths career choices—the role of culture. *Frontiers in education*, *3*, 58.

Alhaddab, T. A., & Alnatheer, S. A. (2015). Future scientists: How women's and minorities' math self-efficacy and science perception affect their STEM major selection. 2015 IEEE Integrated STEM Education Conference,

ASCA, A. S. C. A. (2021). ASCA student standards: Mindsets and behaviors for student success. In *Alexandria, VA: Author*.

ASCA, A. S. C. A. (2023). *The Role of the School Counselor*. https://www.schoolcounselor.org/getmedia/ee8b2e1b-d021-4575-982c-c84402cb2cd2/Role-Statement.pdf

Bandura, A. (1986). *Social foundations of thought and action* (Vol. 1986).

Bandura, A. (1993). Perceived self-efficacy in cognitive development and functioning. *Educational psychologist*, *28*(2), 117-148.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. Macmillan.

Bandura, A. (2006). Toward a psychology of human agency. *Perspectives on psychological science*, *1*(2), 164-180.

Beldon, M., DuBow, W., Hovey, C., Pollich, M., & Sundar, S. (2024). *NCWIT Scorecard: The Status of Women's Participation in Computing*. NATIONAL CENTER FOR WOMEN & INFORMATION TECHNOLOGY NCWIT. Retrieved 03/20/25 from https://ncwit.org/resource/scorecard/

Belford, G. G., & Tucker, A. (2025). *Computer Science*. https://www.britannica.com/science/computer-science

Ben-Zeev, T., Fein, S., & Inzlicht, M. (2005). Arousal and stereotype threat. *Journal of experimental social psychology*, *41*(2), 174-181.

Bergson-Shilcock, A., Taylor, R., & Hodge, N. (2023). *Closing the Digital Skill Divide*. Retrieved 04/16/25 from https://nationalskillscoalition.org/resource/publications/closing-the-digital-skill-divide/?linkId=200301684

Blanco, Á. (2011). Applying social cognitive career theory to predict interests and choice goals in statistics among Spanish psychology students. *Journal of vocational behavior*, *78*(1), 49-58.

Blascovich, J., Mendes, W. B., Hunter, S. B., Lickel, B., & Kowai-Bell, N. (2001). Perceiver threat in social interactions with stigmatized others. *Journal of personality and social psychology*, *80*(2), 253.

Blickenstaff, C. J. (2005). Women and science careers: leaky pipeline or gender filter? *Gender and education*, *17*(4), 369-386.

BLS. (2023a). *May 2023 National Occupational Employment and Wage Estimates*. https://www.bls.gov/oes/current/oes_nat.htm#00-0000

BLS. (2023b). *Occupational Employment and Wage Statistics*. https://www.bls.gov/oes/2023/may/oes150000.htm

BLS. (2024). *Computer and Information Technology Occupations.* https://www.bls.gov/ooh/computer-and-information-technology/home.htm

BLS. (2025). *Employed persons by detailed occupation, sex, race, and Hispanic or Latino ethnicity*. https://www.bls.gov/cps/cpsaat11.htm

Brown, P. C., Roediger III, H. L., & McDaniel, M. A. (2014). *Make it stick: The science of successful learning*. Harvard University Press.

Brown, S. D., & Lent, R. W. (2012). *Career development and counseling: Putting theory and research to work*. John Wiley & Sons.

Bubić, A., & Ivanišević, K. (2016). The role of emotional stability and competence in young adolescents' career judgments. *Journal of career development*, *43*(6), 498-511.

Calabrese Barton, A., Kang, H., Tan, E., O'Neill, T. B., Bautista-Guerra, J., & Brecklin, C. (2013). Crafting a future in science: Tracing middle school girls' identity work over time and space. *American educational research journal*, *50*(1), 37-75.

Carter, S., Griffin, J., Lako, S., Harewood, C., Kessler, L., & Parish, E. (2024). The impacts of COVID-19 on schools' willingness to participate in research.

Census.gov. (2024). *Income in the United States: 2023*. https://www.census.gov/library/publications/2024/demo/p60-282.html#:~:text=Highlights,and%20Table%20A%2D1)

Charleston, L., & Leon, R. (2016). Constructing self-efficacy in STEM graduate education. *Journal for Multicultural Education*, *10*(2), 152-166. https://doi.org/10.1108/JME-12-2015-0048

Cheryan, S., Ziegler, S. A., Montoya, A. K., & Jiang, L. (2017). Why are some STEM fields more gender balanced than others? *Psychological bulletin*, *143*(1), 1.

Coalition, C. o. A., (CSTA), C. S. T. A., & (ECEP), E. C. S. P. (2024). *State of Computer Science Education 2024*. https://code.org/assets/advocacy/stateofcs/2024_state_of_cs.pdf

Creamer, E. (2025). US authors' copyright lawsuits against OpenAI and Microsoft combined in New York with newspaper actions. *The Guardian*. https://www.theguardian.com/books/2025/apr/04/us-authors-copyright-lawsuits-against-openai-and-microsoft-combined-in-new-york-with-newspaper-actions

Creswell, J. W., & Clark, V. L. P. (2011). *Designing and conducting mixed methods research*. Sage publications.

Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research*. Sage publications.

CTE, A. (2023). *The National Career Clusters® Framework*. Retrieved 04/08/25 from https://careertech.org/career-clusters/

Deci, E. L., & Ryan, R. M. (1985). The general causality orientations scale: Self-determination in personality. *Journal of research in personality*, *19*(2), 109-134.

DESE. (2016). Digital Literacy and Computer Science - Grades Kindergarten to 12. In *Massachusetts Curriulum Framework - 2016*.

DESE. (2024a). *2024 Digital Literacy and Computer Science Coursetaking Report (District) - All Students - ALL*. Retrieved 03/24/25 from https://profiles.doe.mass.edu/statereport/computersciencecourse.aspx

DESE. (2024b). *State-Approved Career Technical Education*. https://www.doe.mass.edu/ccte/pathways/cte/default.html

DESTATIS. (2024). *Institutions of higher education Students enrolled in STEM courses*. https://www.destatis.de/EN/Themes/Society-Environment/Education-Research-Culture/Institutions-Higher-Education/Tables/students-in-stem-courses.html

DeVellis, R. F., & Thorpe, C. T. (2021). *Scale development: Theory and applications*. Sage publications.

DOL. (2024). *Percentage of women workers in science, technology, engineering, and math (STEM)*. https://www.dol.gov/agencies/wb/data/occupations-stem

Eccles, J. S., & Wigfield, A. (2002). Motivational beliefs, values, and goals. *Annual review of psychology*, *53*(1), 109-132.

Engagement, U. B. C. (n.d.). *Career Exploration*. Retrieved 03/17/25 from https://career.berkeley.edu/start-exploring/career-essentials/gain-clarity/career-exploration/

EUROSTAT. (2024). *ICT specialists in employment: ICT specialists by sex*. Retrieved 03/17/25 from https://ec.europa.eu/eurostat/statistics-explained/index.php?title=ICT_specialists_in_employment#ICT_specialists_by_sex

Ezell, S. (2021). *Assessing the State of Digital Skills in the U.S. Economy*. https://itif.org/publications/2021/11/29/assessing-state-digital-skills-us-economy/

Field, K. (2022). *The path to a career could start in middle school*. Hechinger Report. Retrieved 03/31/25 from https://hechingerreport.org/the-path-to-a-career-could-start-in-middle-school/

Fouad, N. A., & Santana, M. C. (2017). SCCT and underrepresented populations in STEM fields: Moving the needle. *Journal of Career Assessment*, *25*(1), 24-39.

Galvin, W. F. (2024). *Massachusetts Information For Voters - 2024*. https://www.sec.state.ma.us/divisions/elections/download/research-and-statistics/IFV_2024.pdf

Glessner, K., Rockinson-Szapkiw, A. J., & Lopez, M. L. (2017). "Yes, I can": Testing an intervention to increase middle school students' college and career self-efficacy. *The Career Development Quarterly*, *65*(4), 315-325.

Glynn, S. M., Brickman, P., Armstrong, N., & Taasoobshirazi, G. (2011). Science motivation questionnaire II: Validation with science majors and nonscience majors. *Journal of research in science teaching*, *48*(10), 1159-1176.

Glynn, S. M., Taasoobshirazi, G., & Brickman, P. (2009). Science motivation questionnaire: Construct validation with nonscience majors. *Journal of Research in Science Teaching: The Official Journal of the National Association for Research in Science Teaching*, *46*(2), 127-146.

Gottfredson, L. S. (1996). Gottfredson's theory of circumscription and compromise. *Career choice and development*, 179-232.

Greenhaus, J., & Callanan, G. (2006). Encyclopedia of Career Development. In. SAGE Publications, Inc. https://doi.org/10.4135/9781412952675

Grynbaum, M. M., & Mac, R. (2023). The Times Sues OpenAI and Microsoft Over A.I. Use of Copyrighted Work. *the New York Times*. https://www.nytimes.com/2023/12/27/business/media/new-york-times-open-ai-microsoft-lawsuit.html

Hackett, G. (1985). Role of mathematics self-efficacy in the choice of math-related majors of college women and men: A path analysis. *Journal of counseling psychology*, *32*(1), 47.

Hadi Mogavi, R., Deng, C., Juho Kim, J., Zhou, P., D. Kwon, Y., Hosny Saleh Metwally, A., Tlili, A., Bassanelli, S., Bucchiarone, A., Gujar, S., Nacke, L. E., & Hui, P. (2024). ChatGPT in education: A blessing or a curse? A qualitative study exploring early adopters' utilization and perceptions. *Computers in Human Behavior: Artificial Humans*, *2*(1), 100027. https://doi.org/https://doi.org/10.1016/j.chbah.2023.100027

Hansen, M., & Zerbino, N. (2022). *Exploring the state of computer science education amid rapid policy expansion*. https://www.brookings.edu/articles/exploring-the-state-of-computer-science-education-amid-rapid-policy-expansion/

Hill, C., Corbett, C., & St Rose, A. (2010). *Why so few? Women in science, technology, engineering, and mathematics*. ERIC.

Holland, J. L. (1959). A theory of vocational choice. *Journal of counseling psychology*, *6*(1), 35.

Holmes, A. G. D. (2020). Researcher Positionality--A Consideration of Its Influence and Place in Qualitative Research--A New Researcher Guide. *Shanlax International Journal of Education*, *8*(4), 1-10.

Howard, K. A., & Walsh, M. E. (2011). Children's conceptions of career choice and attainment: Model development. *Journal of career development*, *38*(3), 256-271.

Iyer, S. (2019). Teaching-learning of computational thinking in k-12 schools in India. *Computational Thinking Education*, *363*.

Johnson, M. K., & Mortimer, J. T. (2002). Career choice and development from a sociological perspective. In D. Brown & Associates (Eds.), *Career choice and development* (pp. 37-81). Jossey-Bass.

Kahn, S., & Ginther, D. (2017). *Women and STEM*.

Kausar, T., Choudhry, B. N., & Gujjar, A. A. (2008). A Comparative Study to Evaluate the Effectiveness of Computer Assisted Instruction (CAI) versus Class Room Lecture (CRL) for Computer Science at ICS Level. *Turkish Online Journal of Educational Technology-TOJET*, *7*(4), 19-28.

Kerr, J. F. (1968). *Changing the curriculum*.

Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. FT press.

Kovach, W. E. (2018). *The Effects Of A Career Development Intervention On The Career Aspirations of Middle School Students* https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=2982&context=open_access_dissertations

Leavy, P. (2017). *Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches*. Guilford publications.

Lee, R. (2025). Layoffs.fyi. https://layoffs.fyi

Lent, R. W., & Brown, S. D. (2013). Social cognitive model of career self-management: toward a unifying view of adaptive career behavior across the life span. *Journal of counseling psychology*, *60*(4), 557.

Lent, R. W., Brown, S. D., & Hackett, G. (1994). Toward a unifying social cognitive theory of career and academic interest, choice, and performance. *Journal of vocational behavior*, *45*(1), 79-122.

Lent, R. W., Brown, S. D., & Hackett, G. (2000). Contextual supports and barriers to career choice: A social cognitive analysis. *Journal of counseling psychology*, *47*(1), 36.

Lent, R. W., Brown, S. D., & Hackett, G. (2002). Social cognitive career theory. In D. Brown & Associates (Eds.), *Career choice and development* (Vol. 4, pp. 255-311).

Lincoln, Y. S., & Guba, E. G. (1985). *Naturalistic inquiry*. sage.

Maslow, A. H. (1943). A theory of human motivation. *Psychological Review*, *50*, 370.

mass.gov, C. o. M. (2023). *Governor Healey Launches Free Community College for Massachusetts Residents 25+, Delivers $100,000 to Each Community College for Implementation* https://www.mass.gov/news/governor-healey-launches-free-community-college-for-massachusetts-residents-25-delivers-100000-to-each-community-college-for-implementation#:~:text=Nationally%2C%20employees%20who%20have%20earned,clear%20pathway%20to%20a%20career.%22

MASSCC. (2025). *Fast Facts*. Retrieved 04/05/25 from https://masscc.org/fast-facts/

Master, A., Cheryan, S., Moscatelli, A., & Meltzoff, A. N. (2017). Programming experience promotes higher STEM motivation among first-grade girls. *Journal of experimental child psychology*, *160*, 92-106.

McCartney, R., Boustedt, J., Eckerdal, A., Sanders, K., & Zander, C. (2017). Folk pedagogy and the geek gene: Geekiness quotient. Proceedings of the 2017 ACM SIGCSE Technical Symposium on Computer Science Education,

Merriam-Webster. (n.d). *Career*. Retrieved 05/04/2025 from https://www.merriam-webster.com/dictionary/career

Muro, M., Liu, S., Whiton, J., & Kulkarni, S. (2017). *Digitalization and the American workforce* (Brookings Paper, Issue. https://www.brookings.edu/wp-content/uploads/2017/11/mpp_2017nov15_digitalization_full_report.pdf

Nauta, M. M., & Epperson, D. L. (2003). A longitudinal examination of the social-cognitive model applied to high school girls' choices of nontraditional college majors and aspirations. *Journal of counseling psychology*, *50*(4), 448.

NCES, N. C. f. E. S. (2002). *Education Longitudinal Study of 2002 (ELS:2002)*. https://nces.ed.gov/surveys/els2002/

NCES, N. C. f. E. S. (2009). *High School Longitudinal Study of 2009 (HSLS:09)*. https://nces.ed.gov/surveys/hsls09/

NCES, N. C. f. E. S. (2017). *The Middle Grades Longitudinal Study of 2017–18 (MGLS:2017)*. https://nces.ed.gov/surveys/mgls/

O'Brien, M. (2025). Laying off workers because of AI is more of a fashionable excuse than a real business imperative, study suggests. *Fortune/Associated Press*. https://fortune.com/2025/07/30/why-are-tech-companies-laying-off-workers-ai/

Parsons, F. (1909). *Choosing a vocation*. Houghton Mifflin.

Pham, M., Lam, B. Q., & Tuan Ngoc Bui, A. (2024). Career exploration and its influence on the relationship between self-efficacy and career choice: The moderating role of social support. *Heliyon*, *10*(11), e31808. https://doi.org/10.1016/j.heliyon.2024.e31808

Pintrich, P. R. (2000). Multiple goals, multiple pathways: The role of goal orientation in learning and achievement. *Journal of Educational Psychology*, *92*(3), 544.

Ring, K. (2018). *Women in Tech: India Leads the Way*. Retrieved 03/17/25 from https://go.451research.com/women-in-tech-india-employment-trends.html

Robertson, P. J. (2014). Health inequality and careers. *British Journal of Guidance & Counselling*, *42*(3), 338-351.

Rogers, M. E., & Creed, P. A. (2011). A longitudinal examination of adolescent career planning and exploration using a social cognitive career theory framework. *Journal of Adolescence*, *34*(1), 163-172. https://doi.org/https://doi.org/10.1016/j.adolescence.2009.12.010

Romiszowski, A. (2009). Fostering skill development outcomes. In *Instructional-Design Theories and Models, Volume III* (pp. 211-236). Routledge.

Saldaña, J. (2021). Coding techniques for quantitative and mixed data. *The Routledge reviewer's guide to mixed methods analysis*, 151-160.

Sanders, C., Welfare, L. E., & Culver, S. (2017). Career Counseling in Middle Schools: A Study of School Counselor Self-Efficacy. *Professional Counselor*, *7*(3), 238-250. (Professional Counselor)

Savaglio, L., & Alvarado, C. (2021). A Population Health Perspective on Middle School Success: Activities, Programs, and Policies: Proceedings of a Workshop.

Schaefers, K. G., Epperson, D. L., & Nauta, M. M. (1997). Women's career development: Can theoretically derived variables predict persistence in engineering majors? *Journal of counseling psychology*, *44*(2), 173.

Schroeder, U., Bergner, N., & Leonhardt, T. (2018). Paving the Way for Computer Science in German Schools. In H.-J. Böckenhauer, D. Komm, & W. Unger (Eds.), *Adventures Between Lower Bounds and Higher Altitudes: Essays Dedicated to Juraj Hromkovič on the Occasion of His 60th Birthday* (pp. 590-609). Springer International Publishing. https://doi.org/10.1007/978-3-319-98355-4_34

Shein, E. (2025). The Outlook for Programmers. *Commun. ACM*, *68*(5), 12–14. https://doi.org/10.1145/3715692

Silverman, D. (2021). Doing qualitative research.

Singer, N. (2025). Goodbye, $165,000 Tech Jobs. Student Coders Seek Work at Chipotle. *New York Times*. https://www.nytimes.com/2025/08/10/technology/coding-ai-jobs-students.html?searchResultPosition=1

Singer, N., & Huang, K. (2022). Computer Science Students Face a Shrinking Big Tech Job Market. *New York Times*. https://www.nytimes.com/2022/12/06/technology/computer-students-tech-jobs-layoffs.html?smid=nytcore-ios-share&referringSource=articleShare

Smith, J. L., Sansone, C., & White, P. H. (2007). The stereotyped task engagement process: The role of interest and achievement motivation. *Journal of Educational Psychology*, *99*(1), 99.

Society, T. R. (2017). *After the Reboot: Computing Education in UK Schools*.

Statistics, O. o. N. (2025). *EMP13: Employment by industry*. https://www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/datasets/employmentbyindustryemp13

STEM, W. (2023). *Women In STEM Statistics: Progress and Challenges*. https://www.stemwomen.com/women-in-stem-statistics-progress-and-challenges

Super, D. E. (1980). A life-span, life-spate approach to career development. *Journal of vocational behavior*, *16*, 282-298.

Swanson, J. L., & Fouad, N. A. (2014). *Career theory and practice*. Sage.

Vegas, E., & Fowler, B. (2020). *What do we know about the expansion of K-12 computer science education?*

A review of the evidence. https://www.brookings.edu/articles/what-do-we-know-about-the-expansion-of-k-12-computer-science-education/

Vegas, E., Hansen, M., & Fowler, B. (2021). *Building skills for life* (How to expand and improve computer science education around the world, Issue.

Weaver, K. (2018). Pragmatic paradigm. *The SAGE encyclopedia of educational research, measurement, and evaluation*, *1*, 1287-1288.

Weber, R. P. (1990). *Basic content analysis* (Vol. 49). Sage.

Wiggins, G. P., & McTighe, J. (2005). *Understanding by design*. ACSD.

Wing, J. M. (2006). Computational thinking. *Communications of the ACM*, *49*(3), 33-35.

Yin, R. K. (2004). Case study methods, complementary methods for research in education. *American Educational Research Association, Washington, DC*.