University of Nevada, Reno

Mapping the Field: Out-of-School-Time STEM Programs for K-12 Females

A dissertation submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Educational Specialties

by

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Abstract

Out-of-school-time (OST) STEM (science, technology, engineering, and mathematics) programs for females serve as one strategy to increase females' interest and dispositions in STEM and as a proposed intervention to address the underrepresentation of women in STEM fields. The purpose of this study was to extend previous OST research by investigating OST STEM programs for the subpopulation of females in grades kindergarten through 12. This research contributes to efforts to investigate OST programming by mapping a national sample of OST STEM programs for K-12 females. To determine common features and practices of programs the researcher analyzed 115 websites, 51 survey responses and six interviews with program directors from 38 states. Additionally, it represents all grade levels K-12 and a variety of residential and day-only programs. The findings from this study elaborate on aspects of program design, structure, content, evaluation, funding, staffing and youth audience and thus strengthen knowledge of effective OST practices and the research base on OST STEM programming for females.

Keywords: Out-of-school-time programs, STEM, female, single-sex education

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Chapter One

Introduction

Society has recently paid increased attention to science, technology, engineering and mathematics (STEM). Associated reform initiatives have roots in the United States' expanded effort to improve science education in response to Russia's 1957 launching of the satellite Sputnik in order to compete with the Soviet Union (Bybee & Fuchs, 2006). Despite substantial investments in STEM during the Sputnik era, by the 1970s the sense of urgency had decreased and over time led to the current shortage of STEM professionals (National Science Board, 2010). Between 2001 and 2011 STEM jobs grew three times faster than non-STEM jobs (Langdon, McKittrick, Beede, Kahn, & Doms, 2011). Additionally, STEM occupations are projected to continue to grow by 17 percent from 2008 to 2018, compared to 9.8 percent growth for non-STEM occupations (Langdon et al., 2011). The United States currently suffers a shortage of qualified workers in the STEM workforce (Langdon et al., 2011). The nation lags behind European and Asian competitors in production of STEM professionals (DeJarnette, 2012), with nearly half of doctoral degrees in the natural sciences and engineering earned in the United States since 2006 awarded to foreign nationals (National Science Board, 2010). Further, since the year 2001 foreign-born PhD holders in STEM fields continue to return home after completion of their doctoral studies due to short-term visas and challenges in obtaining work visas (Pagilery, 2013; Park, 2011).

One proposition for addressing the shortage of STEM workers is through increasing the number of STEM degrees awarded to females. Progress has been made in STEM discipline bachelor's degree attainment, with a higher percentage of women than men have earning bachelor's degrees since 2000 (Institute of Educational Sciences, 2014). In 2013, 37 percent of females earned bachelor's degrees compared to 30 percent of males (Institute of Educational Sciences, 2014). In contrast, when bachelor's degree data are disaggregated by STEM discipline, completion differences between men and women are more nuanced. For example, the American Institute for Research (2012) notes:

> The biological sciences and the agricultural sciences are the only STEM disciplines in which women have reached parity and surpassed men in terms of the number and proportion of bachelor's degrees earned. A sizable gender gap persists in engineering and the computer sciences; and unlike their minority peers, there is a substantial degree-attainment gap between White women and White men in the physical sciences, computer sciences, engineering, and the earth, atmospheric, and oceanic sciences (p. 5).

Disproportionate representation continues in employment. Although the number of women in STEM fields has increased since the 1970s, women are significantly underrepresented in engineering and computer science occupations. Further, women's representation in computer science occupations has declined since the 1990's (Landivar, 2013).

Based on a survey of the 500 richest Fortune 500 CEOs, Park (2011) reports that the United States has a serious shortage of STEM workers and has not historically offered a good K-12 STEM education. This is supported by results in international mathematics and science assessments, such as the Trends in International Mathematics and Science Study (TIMSS) and the Programme for International Student Assessment (PISA), which rank American youth below their counterparts in other developed countries (DeJarnette, 2012). Additionally, both the National Assessment of Educational Progress (NAEP) and PISA show significant gaps in achievement, favoring boys over girls, in mathematics achievement in the United States (National Assessment of Educational Progress (NAEP), 2009; OCED, 2017). In response to these concerns, the United States Department of Education prioritized an emphasis on STEM in the $4.35 billion Race to the Top competitive grant funding (U.S. Department of Education, 2009).

Researchers have identified areas for improvement in STEM education, including: teachers' knowledge; attitudes and dispositions; content and curricula; and tests and assessments (Bybee & Fuchs, 2006; DeJarnette, 2012; Gholipour, 2016). Sanders (2009) goes farther, advocating for specific teacher training/licensure programs to prepare pre- and in-service teachers with enough STEM knowledge to implement integrative STEM effectively.

Statement of the Problem

More females are needed to diversify the STEM workforce to a greater degree and to increase the variety of voices that contribute to STEM. For example, when a group of predominantly male engineers designed the first generation of airbags, they were tailored to adult male bodies and thus resulted in avoidable deaths of women and children (Hill, Corbett, & St. Rose, 2010). In addition to enriching society through their participation, women should have an opportunity to participate in fulfilling and rewarding STEM careers. Further, scientific and mathematical literacy are becoming increasingly important for active citizenship and are thus a social justice issue (Mendick & Moreau, 2013).

Despite the need for women in STEM fields, Archer, DeWitt, Osborne, Dillon, Willis, and Wong (2013) argue that science aspirations are "largely 'unthinkable' for girls because they do not fit with either their constructions of desirable/intelligible femininity nor with their sense of themselves as learners/students" (p. 171). STEM degree programs begin with a lower proportion of women than men, and women are more likely to drop out earlier in their academic careers. Further, the number of postsecondary female faculty continues to drop off between earning doctorates and receiving tenure as compared with men (Hill, Corbett, & St. Rose, 2010). To address underrepresentation, Fang (2013) suggests targeting students before they reach high school, and many advocate for specifically targeting the critical transition from middle to high school (Brown, 2013; Dubetz & Wilson, 2013; Lawrence & Mancuso, 2012). Programs for females, however, should not duplicate programs for males but should instead be equitable and use research-based instruction, while incorporating verbal/language arts components, areas in which many females excel (Tyler, Ellison, Lim, & Periathiruvadi, 2012). For example, Jacobs-Rose and Harris (2010) describe a STEM camp designed for high school females based on personal interest of cheerleading in an effort to increase positive perceptions of technology. Effective K-12 STEM education has the potential to teach STEM content and practices, promote positive dispositions and prepare students to be lifelong STEM learners (Fang, 2013). Further, researchers suggest specifically targeting females before and during college (Lawrence & Mancuso, 2012) and leveraging available female role models (Hill et al., 2010).

Out-of-school-time (OST) programs can serve as one strategy to increase females' interest and dispositions in STEM. Cultivating interest is important as indicated, for example, by interviews with female finalists in the Science Talent search, a science-based competition open to all primary and secondary students in Australia, in which interest was cited as a major influence for STEM occupational selection (Heilbronner, 2013). Further, student engagement increases when students are interested in the topic (Weber, 2012). Fang (2013) specifically suggests using informal learning, such as after-school programs, STEM centers, workshops and college outreach programs to expand STEM beyond the K-12 classroom. Single-sex OST STEM programs for women have grown in popularity, evidenced, for example, by the Harvard Family Research Project releasing a research report on STEM OST programs for females (Chun &

Harris, 2011). DiLisi, McMillin, and Virostek (2011) describe one program involving a multi-generational, all-female STEM camp where college students in STEM disciplines mentor high school girls in providing STEM presentations to elementary-grade students. Despite increased interest in OST STEM programs for females, defining quality in OST programs has been elusive (Yohalem & Wilson-Ahlstrom, 2010).

Some OST STEM programs for females collect data for academic research and self-evaluation (e.g., Jacobs-Rose & Harris, 2010; Wiest, 2004). Data are often collected through survey research (Jacobs-Rose & Harris, 2010). Some programs employ outside program evaluators (Koch, Gorges, & Penuel, 2012). Programs who characterize themselves as successful sometimes report key implementation details (Wiest, 2008). Some go farther by providing more general directions for planning a “well designed program” (Lawrence & Mancuso, 2012, p. 11) or a “successful summer program” (Walker, 2012, p. 7). Despite growth in OST STEM programs for females, limited data are available on these programs’ implementation and effectiveness (Chun & Harris, 2011).

Purpose of the Study

Recent studies have begun to investigate and “map” specific types of OST programs to generate insight into common characteristics and concerns (Laursen, Thiry, Archie, & Crane, 2013). Mapping draws on a nationally representative sample of OST programs to understand their design, structure, content, and goals (Laursen et al., 2013). Mapping efforts have included OST programs serving older youth (Porro, 2010), federally funded programs in New York (LaRue, 2013) and programs providing science instruction (Thiry, Laursen, & Archie, 2012). However, attempts to develop measures to assess OST program quality have thus far focused mainly on afterschool programming, likely due to available federal funding (Yohalem & Wilson-

Ahlstrom, 2010). This has motivated some afterschool programs to design their own measures. For example, the state of Rhode Island designed the Rhode Island Program Quality Assessment Tool (RIPQA) to address concerns that no measure was appropriate for their particular afterschool program. The need for individualized measures supports LaRue's (2013) assertion:

> Ultimately quality definitions in the context of afterschool programming vary by a number of contextual issues including the age of the students, the types of needs being addressed, the types of services, supports and opportunities provided and, more often than not, the goals of the funder. (p. 66)

Given that efforts to characterize OST programs have been highly variable and that program evaluations have focused mainly on federally funded afterschool programing, the intent of this study is to contribute to the mapping of particular segments of wider OST program work by investigating the breadth of OST STEM programming for K-12 females in general. Specifically, the purpose is to investigate the most common features of OST STEM programs for K-12 females and key aspects of those programs that are important to their design, operation, and evaluation.

Research Questions

The research questions are as follows:

- What are the most common features of OST STEM programs for K-12 females in terms of such aspects as curriculum, population served, program evaluation and cost to participants?
- What are typical program goals, staffing decisions, and program designs for K-12 OST STEM programs for females conducted in the United States?
- What do program leaders report as important elements for a quality program?

- What do program leaders report as challenges in implementing their program?

Significance of the Study

Prior OST research efforts have focused on individual segments of OST programming rather than a nationally representative sample. Laursen et al. (2013) made the first attempt to describe a nationally representative sample of science-focused programming, asserting that “a greater understanding of the scope and characteristics of OST science, engineering and technology (SET) programs is needed to identify ‘best practices’ and programming models for dissemination and scaling, to craft in-depth studies of youth outcomes, and to identify…opportunities” (p. 2). Components of quality programming as reported by program directors might be used to develop future measures of quality to guide program design and evaluation. This information potentially benefits multiple stakeholders, such as program leaders, evaluators, funders and program participants and the adults who support them. Insight into STEM OST programming for females might lead to greater availability of quality programs and assist in mitigating underrepresentation of females in STEM by encouraging early interest, improved dispositions and stronger academic skill sets.

Further, this topic is timely. One of the three goals in President Obama’s “Educate to Innovate” campaign was to expand STEM education and career opportunities for underrepresented groups, including women and girls (U.S. Department of Education, 2009). Further, Race to the Top competitive grant funding called for states to “prepare more students for advanced study and careers in the sciences, technology, engineering, and mathematics, including addressing the needs of underrepresented groups and women and girls” (U.S. Department of Education, 2009, p. 4). President Trump continued this call by signing the Inspiring the Next Space Pioneers, Innovators, Researchers, and Explorers (INSPIRE) Act, which directs NASA to encourage women to pursue careers in aerospace and promote STEM fields to women and girls (Carson, 2017).

Glossary

- Mapping: “a systematic approach to understnading the “map” of a profession, theory, research question or practice” (Perryman, 2016, p.1).
- Out-of-school-time (OST): time that does not fall into normal school hours during the typical school year (Durlak, Berger, & Celio, 2009)
- Out-of-school-time programs: group programs offered beyond regular school hours by programmers such as community organizations, schools, universities, parks, museums, and recreation departments
- After-school programs: “formal programs for school-age youth that operate outside normal school hours for at least part of a year, are supervised or in someway monitored by adults, and that intentionally seek to promote young people’s growth or development” (Durlak et al., 2009, p. 44)
- STEM: the fields of science, technology, engineering and mathematics (Sanders, 2009)
- Integrated STEM: components of science, technology, engineering and mathematics taught in combination (Park, 2011)
- Participation: the combination of enrollment, regular attendance, and genuine engagement (Durlak et al., 2009)

Overview of Chapters 2-5

Chapter Two of this study synthesizes current literature on OST programming, including theoretical framework, historical overview, types, challenges, reasons for OST programs in STEM for females and best practices. Chapter Three details the research methods, including methodology, sampling, data collection and data analysis. Chapter Four presents the research findings on key program aspects and on what program leaders report as important for a high quality program and as challenges to implementation. Chapter Five is a discussion of the research findings that are situated within current literature. The chapter also presents conclusions and identifies opportunities for future research.

Chapter Two

Review of the Literature

This review of literature synthesizes information about OST STEM programming and its purposes in grades K-12. It begins with a discussion of positioning theory as a theoretical framework for this study. Next, OST programming is defined, followed by an overview of OST program offerings in the United States. In the final sections, elements of quality OST programming are discussed.

Theoretical Framework

I draw on positioning theory to frame and interpret this investigation of United States OST programs. Positioning builds individual identities through social interaction. Lack of a STEM identity is frequently cited as a reason individuals do not pursue STEM disciplines (Krishnamurthi, Ballard, & Noam, 2014). Below I provide a brief overview of positioning theory and discuss how I apply it to OST STEM programming for females.

Positioning Theory and Identity Development

Harré, van Langenhove, and Davies' work on positioning (Davies & Harré, 1990, 1999; Harré & van Langenhove, 1999) is concerned with different possibilities of how people relate themselves to their surroundings. Van Langenhove and Harré (1999) initially theorized positioning theory as "dynamic stability between actors' positions, the social force of what they say and do, and the storylines that are instantiated in the sayings and doings of each episode" (p. 10). Positioning theory views interactions as an unfolding drama with multiple kinds of conversations happening at the same time. Further, it casts participants in both active and passive roles, just as there are lead and supporting actors. This theory describes the ways people arrange social structures through action and speech (Wanger & Herbel-Eisnmann, 2009). This theory has since been connected to mathematics and other education literature as people position themselves, and are positioned, both relative to one another and academic disciplines (e.g., Black, 2004; Evans, 2000). Solomon (2007) goes farther by explaining that positioning oneself facilitates a learner's identity development.

Holland, Lachi-cotte, Skinner, and Cain (1998) credit Harré in leading the way for their description of figured worlds in the development of identity through social interaction. Holland et al. suggest that identities are formed in process or activity (Schwandt, 2007; Urrieta, 2007). It is theorized that identities are produced in the context of figured worlds (Holland et al., 1998, Urrieta, 2007), as domains with their own rules and values (Holland et al., 1998). Holland et al. (1998) theorize that individuals play characters or actors in figured worlds. Individuals develop their identities through activities and social relationships with people who "perform" in their worlds. For example, youth develop identities as they "perform" the role of student in schools. Researchers posit that these social encounters have significance and that people's positions are of importance (Holland et al., 1998; Urrieta, 2007). For example, Archer et al. (2010) found that student's interactions in school lead to some students developing identities that were oppositional to science and reporting a future career in science as "unthinkable". While individuals' identities are formed through the process of living in figured worlds within situations, activities, and artifacts, not all influences come from within figured worlds. Factors outside of figured worlds include: culture, the creation of new worlds, and authorship or voice. Holland et al. (1998) assert that social positions mediated by culture and "defined by gender, race, class, and any other division that is structurally significant potentially affects one's perspective on institutions" (p. 25). Gender is a known mediator of STEM identity, with successful males in STEM disciplines stereotyped as having effortless brilliance and women configured as diligent or hard working (Archer et al., 2010). Identity is also formed through the process of voice or authorship. Through the process of talking about and/or writing about one's identity, individuals come to better understand their own identity. This process allows individuals to reflect upon their identity (Holland et al., 1998).

Researchers propose that females are directly or indirectly told that girls are not good at mathematics (Holland et al., 1998; Gholipour, 2016; Watt, 2000). These messages, set in the context of power, invade their figured worlds, causing the message of not being good at mathematics to become a part of their lived identities (Holland et al., 1998). Further, research indicates that identity plays a significant role in students' beliefs about themselves as mathematics learners (e.g., Boaler & Greeno, 2000). Martin (2009) asserts that mathematics identity "results from the ongoing negotiation of our own assertions and the external ascriptions of others," as well as changes in position and status in the mathematics community (p. 137). Girls seem to develop an identity that is oppositional to doers of mathematics. For example, Watt (2000) found that female participants in her study perceived society as viewing mathematics to be more suited to males. Identities that are oppositional to mathematics are evident even in primary mathematics classrooms, with Black (2004) finding that White middle class boys are more likely to receive invitations to engage in between-equals mathematical talk with teachers, thus positioning them as individuals who belong naturally.

A central assumption of this study is that identities are constructed as individuals enact various roles in different social situations (Nasir, 2002), and thus identity can influence academic, career, and other important outcomes. Given that "learning influences identity, and identity influences learning" (Martin, 2009, p. 137) single-sex OST STEM programming has been suggested as a way to influence females' identities as scientists through addressing attitudes, perceptions and skills in the STEM disciplines using approaches that include female role models and mentoring (Krishnamurthi et al., 2014; Wiest, 2010). Through an investigation of key features of OST programming, this study contributes to knowledge of how programs are designed in order to position females to build identities as doers of STEM. Given that typical classroom instruction tends to foster oppositional identies towards STEM, it is essential to investigate current OST STEM programming practices that attempt to influence positive identities in STEM.

In this study it is assumed that positioning theory guides the mission and implementation of STEM programs for females. Additionally, positioning theory frames the reason for doing the research. Teddlie and Tashakkori (2006) claim that for "researchers working within a transformative-emancipatory orientation, the pursuit of social justice is not a design choice; rather, it is the reason for doing the research, which supersedes design choices" (p. 13). This study applies positioning theory from this perspective, using it as the motivation to engage in the research.

Out-of-School-Time (OST) Programs

Out-of-school-time (OST) refers to the time that students are not in school. This study uses the term OST to include before school, after school, weekends, summer and school breaks. Programs might be residential or day (commuter) events and can be as short as a single day. This study uses the term program to describe group programs offered by programmers, including community organizations, schools, universities, parks, museums, and recreation departments. These programs do not include, for example, youth in unsupervised, unstructured, or one-on-one events, such as private lessons, personal interest clubs, and case-management or tutoring situations (Bodily & Beckett, 2005; Paulsen, 2013). Summer OST programming includes a variety of camps, enrichment and summer school programming (Sun, 2011).

Summer school is a subset of summer learning that is more targeted, as shown in Figure one.

Summer Learning Program	Summer School
Engage students in recreational and/or academic enrichment activities	Focus on academic instruction
Combine academic enrichment and/or advancement with some remediation	Emphasis on remediation
Attended by students from a variety of backgrounds and skill levels	Attended by academically struggling students
Usually voluntary	Frequently mandatory
Usually a full day of activities	Usually half day of activities

Figure 1: Comparison of characteristics of summer school and other summer learning programs (adapted from Sun, 2011).

Perceptions of summer learning and the specific subset of summer school also vary. For example, Augustine and McCombs (2015) found that students considered summer programs “camp-like” and summer school “school-like.”

Historical Overview of OST Programming

OST youth programming arose in response to changing societal needs and economic circumstances. Programming grew to address the needs of single-parent families and families with two working parents who needed childcare. Academic achievement was not, historically, the focus of OST (Hill, 2008). Programming was instead driven by stakeholders and community organizations and included enrichment activities such as sports, community service and leadership. The shift towards an academic OST focus aligned with school reform efforts began in 1983, stemming from *A Nation at Risk* (Hill, 2008). As academic outcomes became the focus of many OST programs, the lines between schools and OST programs became blurred, with schools and OST programs sharing facilities and sharing an end goal of seeking to improve student academic success (Hill, 2008). As schools and OST programs shared a focus on academics, some programs shifted towards the goal of preparing students for standardized assessments (Krishnamurthi et al., 2014). As another academic OST effort, the U.S. Department of Education launched its 21st Century Community Learning Centers afterschool program in 1998, which provided competitive grants to local education agencies (LEAs) for OST programming (Weiss, 2000). Recently, as schools have faced budget cuts in music, arts and physical education, many OST program directors report increasing time spent on these co-curricular areas and offering "youth a voice, choice and control over their own learning" (Krishnamurthi et al., 2014, p. 4).

Types of OST Programming

In a review of literature, Roth, Malone, and Brooks-Gunn (2010) grouped OST programs according to seven outcome goals:

1. academic performance
2. academically-related attitudes and beliefs
3. learning behaviors
4. attendance
5. problem behaviors
6. peer relations
7. self-concept

OST programs are also classified into district providers and non-district providers. District providers are programs run by or affiliated with school districts and are often conducted on district sites (Roth et al., 2010). Academic programs may be categorized as enrichment, intervention, remediation, or a combination of these (Wiest, 2010). These outreach experiences vary from a few hours in a single day to summer-long programs (Dave et al., 2010; Wiest, 2010, Wiest et al., 2017) and provide experiences not typically available in the classroom enviroment (Bhattacharyya & Mead, 2011).

Challenges in OST Programming

Through an evaluation of 34 academically focused summer programs, The Harvard Family Research Project (2006) identified the following challenges to implementing high-quality summer programs:

1. developing programming with intentionality
2. building positive and individualized connections with youth
3. recruiting and developing highly skilled staff
4. developing ongoing, mutually supportive relationships with schools
5. building strong, positive connections with participants' families
6. engaging community members, groups, and institutions in programs
7. incorporating a variety of fun and engaging program activities. (p. 2)

Sustainability is another challenge for publicly funded OST programs. Bodily et al.'s (2010) study of OST programs in five cities indicated that the programs had to continually advocate for funding by providing attendance and survey data with evidence that funds were being used effectively. Sun (2011) also identified financial concerns as a primary issue for summer programs. Outside of summer school, funding is limited for summer academic programs, with most providers piecing together funding from a variety of sources (Bodily et al., 2010). When programs struggle to find outside funding, they frequently supplement with increased tuition (Grossman, Lind, Hayes, McMaken & Gersick, 2009), which disproportionately excludes low-income students and thus makes it difficult to provide quality summer learning for all students (Bodily & Beckett, 2005). Further challenges include the time and work required to run and operate an OST program and securing appropriate facilities, equipment and materials (Wiest, 2010).

Data collection is another challenge to OST programming. OST programs have not traditionally invested in data collection systems and thus cannot always accurately report enrollment, participation, activities or outcomes (Bodily et al., 2010). McCombs et al. (2010) found that when after-school programs were provided support and funding to address these information management concerns, the data had potential to improve access and services by providing funders with information on enrollment and participation. One interviewee in their study noted, “The benefit has been that now we know who we are reaching and how much money we are spending” (McCombs et al., 2010, p. xvi). This descriptive case analysis was conducted with eight major United States cities’ publicly funded after-school providers, in which programs used the data to alter current OST offerings and plan for future offerings. Some programs additionally chose to share information with other stakeholders and service providers, such as the public schools, the local department of education and an agency that provided care for birth to school-age children. They then used data to strengthen the continuity of services for participants.

In McCombs et al.’s study (2010), implementation of information management systems was not without challenges. Despite possessing such systems, providers reported a lack of training. They thus requested training, particularly advanced training in how to analyze, interpret, and share information. Further, OST sites in this study expressed concerns regarding the time strain on staff to enter data. One participant stated, “For small organizations like ours, unless funding and personnel problems are solved, it will be challenging to get the most out of the system” (p. xix). Other interviewees went farther, expressing concerns that the data collection was not in the best interest of the programs but was rather a form of micromanagement (McCombs et al., 2010). Despite challenges faced, OST programs have continued to increase at a high rate (Chun & Harris, 2011).

Reasons for OST Programming

Approximately 8.4 million children per year participate in OST programing (Krishnamurthi, Ballard, & Noam, 2014), Considerable private, federal, local and state monies are being invested in OST programs, with estimates as high as $3.6 billion in federal funding being invested in after-school programs alone (Cross, Gottfredson, Wilson, Rorie, & Connell, 2010). Interest in OST programs has increased during the past decade, due in part to the wide range of stakeholders, including youth, parents, policy makers, schools and youth organizations (Hirsch, Mekinda, & Stawicki, 2010). This interest might be due, in part, to recognizing OST as a possible alternative to risky, unsupervised activities that might take place beyond the school day (Cross et al., 2010). For example, interviewees in police departments were supportive of after-school programming for older students to potentially reduce criminal activities as well as the likelihood of being a crime victim (Bodily et al., 2010). Supervised activities have indeed been associated with better educational achievement and fewer problem behaviors (Roth, Malone, & Brooks-Gunn, 2010). Academic OST programs seek to promote learning for all students or for particular subpopulations (Wiest, 2010), but structured activity can have the added benefit of monitoring and thus guiding behavior.

Academic summer programs seek to mitigate learning loss during students' time off between school years. Known as "summer slide," students lose one month of knowledge and skills on average during a summer, with low-SES students showing greater loss than their high-SES peers (Graham, McNamara, & Lankveld, 2011; McCombs et al., 2012; Smith, 2012).

Achievement loss is particularly noticeable in mathematics (McCombs et al., 2012). Further, this loss is cumulative over time and, thus, summer learning loss contributes to the SES achievement gap (McCombs et al., 2012). However, students who attend summer programs show better outcomes than similar youth who do not attend such programs, in some cases, even making achievement gains (Auger, Pierce & Vandell, 2013). Longitudinal studies indicate that these gains are apparent for at least two years after the student participates in an academic summer program (McCombs et al., 2012). Potential benefits extend beyond academics. For example, Durlak and Weissberg (2007) found that students participating in afterschool programs had significant increases in positive social behavior, decreases in problem behaviors and improvement in self-perceptions. Other OST programs have shown similar results. For example, regular attendance in afterschool programs correlates with improved work habits, higher levels of persistence, and increased school attendance (Vandell, Reisner, & Pierce, 2007).

Science, Technology, Engineering and Mathematics

The acronym STEM evolved from the 1990s when the National Science Foundation (NSF) used “SMET” for science, mathematics, engineering and technology. However, when complaints were received that “SMET” sounded like “smut,” STEM was born (Sanders, 2009). Breiner, Harkness, Johnson, and Koehler (2012) note:

> In recent years, the use of the acronym STEM (science, technology, engineering and mathematics) has become the buzzword among the many United States stakeholders who have heeded the call for creating better prepared high school and college graduates to compete globally. But what is STEM? Does this acronym say enough? It may appear that STEM is a simple acronym, but do all the various partners with vested interests understand it in the same way? (p. 3)

The K-12 system espouses multiple perspectives on STEM education. Educators typically report STEM as including a shift from lecture-based instruction to inquiry project-based instruction. Educators often see science, technology, engineering and mathematics as distinct subjects (Breiner et al., 2012), and some stakeholders use the terms science, mathematics and technology interchangeably with STEM (Breiner et al., 2012). Historically, the NSF has defined STEM as four separate and distinct fields (Sanders, 2009). In contrast, Park (2011) contends that STEM must integrate components of science, technology, engineering and mathematics because if each field in STEM is taught separately, then STEM is essentially the subject areas we already teach. STEM professionals tend to agree with Park's integrative conceptualization because they naturally practice integrated STEM. Breiner et al. (2012) support this idea by stating, "An engineer needs a well developed understanding of the various science disciplines, math and technology to support and provide context for their engineering design applications" (p. 5). Further, even when stakeholders are narrowed to STEM faculty members in a research intensive institution, Breiner et al. (2012) found that they did not share a conceptualization of STEM, nor did they agree on the usefulness of STEM in daily life. Due to the various definitions of STEM, authors of reports on STEM job outcomes, such as those from the United States Department of Commerce, must define which jobs and degrees constitute STEM (Langdon et al., 2011).

Reasons for OST STEM Programming

The National Assessment of Educational Progress (NAEP) found that fourth graders who reported engaging in hands-on science activities had significantly higher test scores than students who did not (Krishnamurthi et al., 2014). However, students do not always have an opportunity to learn in a student-centered manner. For example, students are unlikely to experience inquiry-based learning in the classroom, particularly in the elementary grades (Bencze, 2010; DeJarnette, 2012). Instead of opportunities to engage STEM content through solving problems and constructing knowledge, students tend to acquire knowledge through more passive approaches, such as reading science texts (DeJarnette, 2012). To help address pedagogical concerns and offer early exposure to STEM, DeJarnette (2012) suggests developing summer camps, classes and workshops for students to experience hands-on scientific inquiry and engage with STEM content. Summer, however, is of particular concern because summer learning loss is greater in mathematics than literacy, perhaps because of the multi-step procedural processes of many mathematics skills (Sun, 2011). OST STEM programs are usually designed for participants to explore STEM content and careers, apply STEM to real-world settings, develop awareness of the utilitarian value of STEM, and inspire interest in STEM (Afterschool Alliance, 2013; Mohr-Schroeder et al., 2014; Wilkerson & Haden, 2014).

These K-12 STEM-related issues are cause for concern, given that in the United States graduates with STEM degrees have not been equal to the need expressed by business and government leaders (Paulsen, 2013). In response to this perceived need, billions of dollars have been invested to increase STEM opportunities and achievement (Paulsen, 2013). Further, given that STEM fields are estimated to have grown three times faster than non-STEM occupations in the U.S. economy during the past ten years, it is estimated that by 2018 there will be over 200,000 unfilled advanced degree STEM jobs (Information Technology Industry Council, 2012).

STEM fields offer employees a number of benefits. For example, STEM workers earn 26 percent more than their non-STEM counterparts, and STEM degree holders earn more whether or not they work in STEM occupations (Information Technology Industry Council, 2012; Langdon et al., 2011). In addition to higher earnings, workers in STEM occupations on average experience lower unemployment rates, with some fields experiencing far lower unemployment rates (Langdon et al., 2011). Petroleum engineers, for example, have an unemployment rate of only 0.1% (Information Technology Industry Council, 2012). Further, these higher earnings and reduced unemployment benefits exist regardless of educational attainment.

In response to these concerns, many OST STEM programs seek to encourage participation and persistence in STEM coursework and career paths (Wiest, 2010). Longitudinal studies indicate that participation in STEM OST programs increase the likelihood that adolescents will pursue STEM undergraduate degrees compared to non-participants (Thiry et al., 2012).

Reasons for OST Programming for Women

STEM careers offer growth, stability, high wages and status, so it is worrisome that females show less confidence, interest and persistence in STEM than males (Wiest et al., 2017). Many factors contribute to the underrepresentation of women in STEM fields, including a perception of these fields as masculine (Dave et al., 2010) and girls' preference to pursue careers that they perceive as social and helpful, characteristics often not associated with STEM disciplines. OST STEM programs are increasingly suggested to address women's underrepresentation and weaker dispositions and skills in STEM (Wiest et al., 2017), with one strategy being to include female role models and mentoring (Wiest, 2010). Accordingly, OST programs targeting females in mathematics increased 140% in less than a decade (Cavanagh, 2007).

Quality of OST Programs

Overview of Characteristics

A description of quality for OST is still in its infancy, complicated by great heterogeneity in programming and program outcomes (Cross et al., 2010). In terms of after-school programming, Durlak et al. (2010) assert that there is not one standard form or operating procedure. These programs differ in "location, size, staffing, funding, hours of operation, activities and structure, and, most important, in their general mission and specific goals" (p. 287). Further, there are few agreed-upon titles for OST staffing, with a survey of 350 respondents reporting staff with 207 different titles (Dennehy, Gannett, & Robbins, 2006). Variety in after-school programs is affected by available funding, staff and the needs of the local community (Durlak et al., 2009). This diversity is also true in terms of OST STEM programming, with great variety in terms of science materials and STEM support (Means, House, & Llorente, 2011). In regard to OST STEM programs, Wiest (2010) claims that, "effective programs are those that yield positive results in relationship to…worthwhile goals, in particular, intent to improve participant content knowledge and skills, dispositions, and participation and persistence in one or more disciplines" (p. 59). However, interpretation of these criteria varies by program, with individual programs citing a variety of criteria in program evaluation documents (Yohaelm & Wilson-Ahlstrom, 2010) . Despite variation in defining best practice, there is a relative consensus of key features in successful OST programs.

In their review of literature, Bodily and Beckett (2005) found that the following characteristics might be associated with improved OST-program outcomes:

- a clear mission
- high expectations and positive social norms
- a safe and healthy environment
- a supportitive emotional climate
- a small total enrollment
- stable, trained personnel

- appropriate content and pedagogy relative to the children's needs and the program's mission, with opportunities to engage integrated family and community partners
- frequent assessment (p. xv)

Sun (2011) added the following nine elements of quality instruction specific to summer OST programs:

- smaller class size
- differentiated instruction
- high-quality instruction
- curriculum aligned with school year
- comprehensive programming
- high attendance rates
- appropriate duration of the program
- parental involvement
- effective evaluations

Despite the relative agreement of favorable OST program factors, these features have not been formally tested in experimental studies. This lack of rigorous research is due, in part, to variety of populations, participant attrition, lack of comparison groups, and variability in implementation (Thiry et al., 2012). Areas researched with experimental studies include participation and staffing (Thiry et al., 2012). Durlak et al. (2009) elaborate that to implement effective after-school programs one must have a clear logic model with specific goals, an implementation plan and an evaluation component.

How OST Quality is Measured

Bodily et al. (2010) argue that attendance is an indicator of quality because a positive program experience in itself might be a measure of program quality. This proxy assumes "that children would vote with their feet and that poor-quality programs would be visible by poor attendance" (Bodily et al., 2010, p. 51). Positive experiences provide a feedback loop that influences future attendance. McCombs et al. (2010) report that publicly funded after-school programs in New York reported improving quality by managing average attendance rates disagregated by subgroups to identify potential quality problems. Recruiting efforts might additionally increase attendance. Using attendance as a measure of quality, however, has been questioned.

For example, Hirsch et al. (2010) contend, "in the pursuit of designing quality programs, programs would be better served to look at the features and aspects of implementation that increase program participation and youth engagement rather than focusing predominately on enrollment figures on youth attendance" (p. 449). Durlak and Weissberg's (2007) meta-analysis concluded that not all programs are designed and implemented in a way that promotes positive results. The differing degrees of success make defining program quality, developing criteria for high-quality programs and developing ways to improve program quality challenging in the OST field (Yohalem & Wilson-Ahlstrom, 2010).

Instruments designed to measure both self and external evaluation of quality in after-school programs appear in the OST literature. Measures are more commonly specific to after-school programs than summer programs. This is likely due to the federal funding allocated to after-school programs. At this early point in development, research-based instruments include those whose development was informed by research and those measures whose technical properties have been studied. In a review of research-based OST evaluation tools, Yohaelm and Wilson-Ahlstrom (2010) found several similarities in the definition of quality. All tools measured the following: relationships, environment, engagement, social/behavioral norms, skill-building opportunities and routine/structure. For additional characteristics measured by some evaluation tools, see figure two.

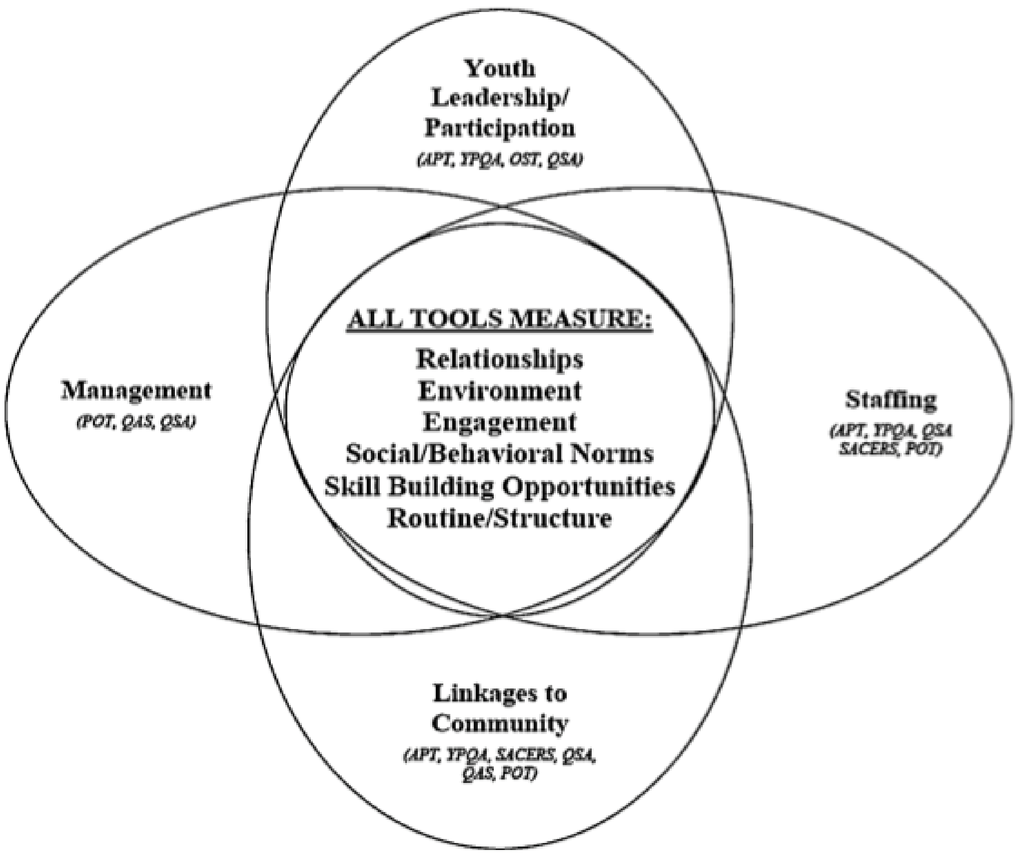

Figure 2. Key constructs measured by different program evaluation tools (Yohaelm & Wilson-Ahlstrom, 2010, p. 353).

Unlike attendance, program quality is challenging to assess. In Yohaelm and Wilson-Ahlstrom's (2010) evaluation, even when definitions of quality were similar, how quality was measured differed. Some researchers have focused on overall quality by looking at successful implementation of designs (e.g., Sheldon et al., 2010), whereas others have investigated program features linked to participant outcomes (e.g., Pierce, et al., 2010). Key features in OST programming identified in literature are presented below, aligned to the categories measured by common OST program evaluation tools.

Youth Participation and Leadership

Student participation in OST programs has been linked with positive outcomes when compared to non-participation (Wiest, 2010). In a meta-analysis of OST programs, the greatest effect sizes for improving reading and mathematics achievement were for programs that lasted 45 or more hours (Lauer et al., 2006). This did not, however, address the actual time or duration that youth participated, but rather the time available for participation (Lauer et al., 2006). Similarly, Roth, Malone, and Brooks-Gunn (2010) found that optimal total exposure thresholds of actual participation ranged from 49 to 60 days. To address differences between available time and participation time, Roth et al., (2010) recommend that future studies compare participants with levels above and below a specific threshold of participation time to contribute to the literature regarding optimum amount of participation time necessary for favorable outcomes. Some researchers additionally assert that participation should be more than attendance and involve active engagement in a program (e.g., Maxwell-Jolly, 2011; Roth et al., 2010).

Despite attempts to identify proposed key features, it is unlikely that “a specific feature will have the same impact among all youth” (Hirsch et al., 2010, p. 449). This is relevant considering that subpopulations of students do not participate in OST programming at the same rates. Research has shown patterns of differential participation in after-school programs. Children with the following characteristics tend to be overrepresented in K-8 after-school programs: Black children, Hispanic children, children with a single parent, and two-parent families where the mother works (Bodily & Beckett, 2005). This overrepresentation might, in part, reflect the subsidized nature of many OST programs, particularly after-school programs, as lower-income families are more likely to enroll in subsidized programs (Bodily & Beckett, 2005). Hynes and Sanders (2011) found that Black children were twice as likely as White children to attend after-school programs and that the racial gap in program use is increasing. Similarly, Porro (2010) suggests that the majority of STEM programs serving older youth target underserved students.

To address these concerns for OST STEM programs for females, Koch, Gorges, and Penuel (2012) specifically suggest targeting students who lack regular access to technology. Similarly, the Build IT girls' computer science camp actively recruits girls who are African American, Latina and from low socioeconomic status households (Koch et al., 2012). These recommendations mirror those from the STEM field, indicating a need to address the unique intersections between personal identities (e.g., gender, race/ethnicity, and income level) and the chosen STEM career. Further, researchers should disaggregate data on women in STEM by race, sexual orientation and SES to understand how they intersect (President and Fellows of Harvard, 2011).

Similarly concerned with disproportionate program participation by different student populations, Bodily and Beckett (2005) suggest that the students who participate in voluntary OST activities differ from students who do not participate. They suggest that "those who self-select to join programs might have significantly different motivations or aspirations than those who choose do not participate" (p. 44). This could lead to favorable conclusions for programs that might, in part, be attributed to participant motivation rather than solely program features.

Bodily and Beckett (2005) classify factors associated with participation in the following categories: motivations, intentions and environmental factors. Environmental factors can be associated with participation. Some of these factors include lack of information available about OST opportunities, scheduling conflicts with youth's other obligations, and access constraints including cost and transportation (Dave et al., 2010). Access constraints factor more heavily for students of low socio-economic status (SES). These students tend to face barriers not only with program-related costs, but also with physical access to programs in their own neighborhoods (Bodily & Beckett, 2005). Bodily et al. (2010) identified the following efforts of after-school programs to increase access and participation: addressing transportation needs, increasing convenience, increasing the number of locations, increasing enrollment, and ensuring affordability. Barriers vary by program. Consider, for example, a comparison of a subsidized after-school program held at the local elementary school and a for-profit summer program held at a museum that requires self transportation. A program that requires paying a participation fee and arranging transportation to and from the program site has greater barriers. Further, summer programs might need to adopt more strategies than after-school programs to address practical factors such as providing transportation and offering full-day programs (McCombs et al., 2012). Drawing on research from military recruiting, job training and the arts, Bodily and Beckett (2005) identified the following factors to increase youth intention to participate: clearly perceived benefits, lack of benefits from competing activities (e.g., unsupervised time), supportive key influencers, and positive program experiences. Further, Bodily and Beckett suggest recruitment techniques for OST participation to ensure that all potential participants are aware of the program and the opportunities presented by the program. Recruitment might be accomplished by sending mailings of materials in multiple languages, holding registration in areas that families with youth frequent, and using recruiters to identify youth with a high likelihood of attendance, for example, at back-to-school nights, parent-teacher conferences, local community centers, faith-based organizations, and welfare and housing centers.

Some have called attention to the importance of student voice for encouraging youth leadership and as a method for increasing participation. For example, Chen et al. (2010) found in a participatory action research study of Girls Incorporated OST programs that suggestions from female participants requested changes to programs to increase participation. For example, some proposed making changes to a teen pregnancy prevention program, adding a career preparation program, and including science and mathematics programs (Chen et al., 2010). These varying recommendations support the need to include girls' voices in the planning of OST opportunities for females in order to create programs that girls are likely to opt into attending.

Staffing and Leadership

In a study of five middle school OST programs, Cross et al. (2010) found that programs with high-quality staff and a positive affective environment had high levels of student engagement. Staffing characteristics have also correlated with student participation rates. For example, a study of 550 after-school programs in New York City showed that elementary school programs that employed directors with advanced education had higher program attendance rates (Pearson, Russell, & Reisner, 2007). Durlak, Berger, and Sasha (2009) cited strong leadership as one of ten guidelines for running an effective after-school program: "The program director should provide adequate structure while providing support and boosting morale" (p. 55). Similarly, Sheldon, Arbreton, Hopkins, and Grossman (2010) suggested hiring a full-time director to coordinate staff training and thus impact quality of teaching.

Cross et al. (2010) identify staffing issues, including hiring, training and maintaining well-qualified staff, as a concern for OST programs. Further, returning staff can be important for program continuity (Wiest, 2010). Koch et al. (2012) note:

> In youth organizations, staff turnover is high. Organizations may train staff to implement a program one year, only to lose those staff the next year. A process for inducting new staff to support the program and providing for ongoing professional learning can help maintain capacity. (p. 64)

Bodily et al. (2010) found that providing professional development opportunities to OST providers strengthened services at the system level. Adequate staff training ensures that staff is trained to effectively conduct activities such as tutoring or skill building (Durlak et al., 2009). In a review of professional development in OST, LaRue (2013) details the array of opportunities, which include workshops, webinars, multi-day institutes, site visits, university courses, professional credential programs, one-on-one coaching, mentoring and on-site consultations. Further, specific OST professional credentialing programs are in their infancy, including university certificates in school-aged care (LaRue, 2013). Some programs partner with extablished OST providers for professional development trainings due to their greater infastructure. For example, the Build IT Computer Science OST program for girls partnered with Girls Incorporated affiliates to assist in professional development trainings (Koch, et al., 2012). Similarly, Horizons National OST provides trained staff to individual sites; however, they provide autonomy in curriculum planning, stating, “We invest in hiring experienced, excellent teachers from both public and private schools who work side by side and learn from one another, creating hands-on and project-based learning opportunities that reflect their unique schools and communities” (Smith, 2012, p. 63).

Engagement and Environment

Maxwell-Jolly (2011) and Roth et al. (2010) argue that participation means active involvement in a program. Roth et al. (2010) explain:

> Engagement refers to the cognitive, behavioral, and emotional attributes at the afterschool program. In program research, engagement is typically measured by such constructs as youths' sense of belonging to the program or the effort, enjoyment, and interest youth express during activities. (p. 320)

Shernoff (2010) suggests that the quality of experiences, particularly in academic programs, might be a more important factor than program duration. He says, "No study to date, however, has systematically examined the role that quality of experience plays in the relationship between after-school program participation and positive social and academic outcomes" (p. 326).

Engagement might, in part, relate to the environment of the OST program. For example, in a participatory action research study of Girls Incorporated OST programs, female participants called attention to the importance of feeling connected and environments that supported them in building self-confidence. Environment might be particularly important for STEM programs specific to females. A single-sex setting can be beneficial for females in STEM programs (Cavanagh, 2007; Rosenthal, London, Levy & Lobel, 2011). Single-sex environments allow girls to do more of the hands-on and technological work more frequently than co-educational programs, as males tend to dominate these activities (Cavanagh, 2007). Further, girls might be more likely to feel comfortable presenting their ideas and their work in a single-sex setting, be more assertive, demonstrate greater leadership without the pressure of gaining approval from male classmates, and be less likely to be relegated to an auxiliary position, such as note-taker, in STEM activities (Crawford-Ferre & Wiest, 2013).

Engagement might relate to OST participants' programming choices. For example, Roth, et al. (2010) found that variety in activities, both academic and non-academic, might lead to greater youth engagement. This proposed relationship is tentative, with some arguing that activities that are too much like schools lessen student engagement and others arguing that the basic purpose of these programs is to better prepare students for academic settings, which can best be done in a school-like setting (Means et al., 2011). Wiest (2010) suggests that a more balanced setting of academics and recreation leads to the building of more complete relationships with peers and staff. Similarly, LaRue (2013) asserts that, in relation to after-school programs, co-curricular enrichment activities are essential for well-rounded youth development because schools increasingly limit access to arts and recreation. However, research in this area has limited scope because research cannot be conducted on all activities in which students participate (Roth et al., 2010).

Relationships

Relationships can play a key role in which students do and do not participate in OST programs. Durlak et al. (2009) note that parent relationships and input is valuable because parents can be a strong influence on whether or not children attend a program. The In Addition Mathematics Club additionally found that parental involvement was key to having parents embrace a mathematics education that was different than their own (McVarish, 2008). Further, Hynes, Miller, and Choen (2010) assert that using relationships and specific recruitment and retainment strategies is necessary for some subpopulations, such as older youth. Similarly, Bodily et al. (2010) suggest conducting marketing activities to appeal to underparticipating groups.

Although connections with families and outreach are important for all OST, it is specifically important for females because OST programs are often voluntary and self-selected. Girls might be less likely to attend without targeted outreach due to additional home and child care responsibilities and stereotypes about the appropriateness of STEM disciplines for females (Froschi et al., 2003). Further, outreach might address the diversity of science careers given that, in a study of girls' and parents' perceptions of science, children and parents saw science jobs as limited to being a doctor, scientist or science teacher (Archer et al., 2013).

All-female programs can also leverage relationships to provide female role models and mentors, as well as networking with female peers. Many programs solely employ females to serve as role models (Koch et al., 2012; Wiest, 2004). Role models can be provided through various means, such as posters, flyers, brochures, video clips and guest speakers. Milgram (2011) asserts that female role models are the secret to success in recruiting women into STEM classrooms and careers. Further, Milgram highlights the successful outreach campaign to recruit women into male-dominated jobs during World War II. During this time the United States government created "Rosie the Riveter" based on the real female factory worker, Rose Monroe. The successful outreach conducted nationwide used posters with the phrase "We Can Do it!" to send the message that it was the patriotic duty of women to work in the factories. The campaign worked, with the number of females in the workplace increasing by 57% within four years.

Figure 3. “We Can Do it!” posters to send the message that it was the patriotic duty of women to work in the factories during World War II.

Wiest (2010) further suggests providing girls with historical and contemporary female role models, female staff members and other mentors in the STEM disciplines. Milgram (2011) notes that successful modern outreach campaigns must emphasize how women can balance STEM career demands with family and personal responsibilities. She suggests that role models share not only how they arrived at their careers but also their personal interests and family stories. Finally, when possible, have female STEM role models share how STEM is used to make a difference in the world, given that research shows that females tend to care most about how STEM is used to help others (Girls Scout Research Institute, 2012; Seron, Silbey, Cech & Rubineau, 2016). Mentoring is further suggested as a way to support women in academia (Gorman, Durmowicz, Roskes, & Slattery, 2010) in response to research data indicating that 40 percent of the United States’ female and underrepresented minority chemists working today report being discouraged from pursuing their STEM career (Bayer Corporation, 2012). Gorman et al. (2010) support these findings, advocating for formal one-on-one and group mentoring to support an increased number of full-time female STEM faculty.

Support Systems and Links to the Community

When selecting promising OST programs to receive Wallace Foundation grant funding, support networks were considered (Bodily et al., 2010). The Wallace Foundation identified three cities with strong political support. In particular, programs in Providence, Rhode Island were selected because of the strong mayoral support for OST programming. Bodily et al. (2010) found that programs with strong political support were more likely to continue receiving funding during times of economic downturn. In contrast, after-school programming in Boston was described as a fledgling program after the executive director resigned because of a perceived lack of confidence from the mayor (Bodily et al., 2010). Support from policymakers might also influence funding. States differ in funding for after-school programming based on the support of policymakers (Durlak et al., 2009). Due to the power of policymakers, the Minnesota Department of Education commissioned a report to identify potential primary and bridge funding streams for OST programs to inform key stakeholders, including legislators (Minnesota Department of Education, 2012).

The school superintendent, central office staff and principals were additionally reported as crucial supports by programs that relied on using school facilities to host OST programs. Programmers reported that they needed basic support to ensure facilities would be open, and that maintenance, heating, cooling and insurance demands would be handled by the school (Bodily et al., 2010). Further, OST programs needed outreach support in encouraging students to attend the programs (Bodily et al., 2010). Key influencers might include principals, teachers, and teachers' aides that work in K-12 schools and universities. For example, the Build IT Computer Science

OST program for girls partnered with Girls Incorporated affiliates to assist in professional development, funding, research and evaluation (Koch, Gorges, & Penuel, 2012).

Skill Building, Curriculum and Standards

Cross et al. (2010), in discussing OST programs focused on substance abuse and social skills, assert that although the field lacks specific recommendations for content, programs should incorporate the research-based best practices for which there is relative consensus. Although there is agreement that programs should have strong, focused academic curriculum (Froschi et al., 2003; Wiest, 2004) with opportunity for enrichment (Froschi et al., 2003), a standardized curriculum across programs is lacking. Durlak et al. (2009) make a general OST curriculum suggestion, saying, “Make sure your materials reflect the ability level of your participants so as to be challenging but not overwhelming. Make sure that resources are available to achieve your program goals” (p. 55). The lack of standardized curriculum might contribute to challenges in studying OST programs. Implementation fidelity might explain, in part, why some programs work and others do not (Cross et al., 2010). Specific to STEM, many freely available curricula are available, however, the availability of the materials does not ensure that they are used as intended (Means et al., 2011). Additionally, open source material must be carefully vetted for accuracy and high-quality pedagogical practices. Even with high-quality materials, large organizations providing the materials do not know who is using them or how they are being used (Means et al., 2011).

STEM OST programs often have social goals, academic goals or a combination of the two. Social outcomes might include simultaneous benefits such as exposure to positive role models, opportunities to set long-term goals, such as career planning, and opportunities to improve social skills or self-understanding (Shernoff, 2010). Academic and achievement gains are typically measured as grades attained in school, achievement on standardized assessments (Vandell, Reisner, & Pierce, 2007), and secondary academic measures such as attendance (Shernoff, 2010). Educational-related activities can favorably impact academic achievement (George, Cusick, Wasserman, & Gladden, 2007), and resources such as academic support and exposure to new things, for example, field trips and academic programs, have also been shown to be important (Chen, Weiss, & Nicholson, 2010).

Fancsali (2008) describes the "research on effective strategies for teaching science and fostering interest and persistence in STEM" used to guide The Science Mentoring Project (p. 8). The Science Mentoring Project practiced collaborative learning and hands-on experiences with practical applications. The project included staff that was trained to use curriculum based on National Science Education Standards and who could serve as gender and ethnically diverse role models. Further, Fancsali (2008) suggests collaborating with science-rich local institutions and building collaborations between schools and after-school programs.

Based on research with the In Addition Mathematics Club, McVarish (2008) suggests using academic standards established in the National Council of Teachers of Mathematics *Principles and Standards for School Mathematics* to plan content for an after-school mathematics program and using problem-based, real-life learning to create a deeper understanding of mathematics. McVarish found, however, that despite best intentions to avoid spending time on homework assigned during the school day, in the afterschool setting the pressure of homework led students to drop out of the program and for parents and administrators to insist that afterschool programming provide time for homework help each day, an action that detracted from the mission of the program. Similarly, in a study of after-school programs that included homework and tutoring time, Shernoff (2010) found growth in English measures, but not mathematics measures. This might indicate the importance of a STEM-instruction focus rather than general academic goals or tutoring, even for programs that allow for homework time.

Recommended Research

A case has been made for the potential benefits of OST programs. However, individual program aspects have often not been studied in general or thoroughly investigated because of the overlap for specific subpopulations (McCombs et al., 2012) such as the disproportionate overrepresent of participants of color and low SES in subsidized programs (Hynes & Sanders, 2011). Thiry et al. (2012) specifically identify OST programs with STEM curriculum as an area in need of future study. Given the perceived need for OST programs for females in STEM disciplines, this represents a subpopulation for whom to investigate best practices, particularly since research on OST programs that focus specifically on girls with an emphasis on STEM is scarce (Chohlis, 2014). Further, Granger (2010) suggests that there be a shift of OST research questions from whether or not programs work to why programs make a difference. Policy makers and practitioners can benefit from useful information on how to improve program effectiveness. Thiry et al. (2012) suggest:

> Greater understanding of the scope and characteristics of OST SET [science, engineering, technology] programs is needed to identify “best practices” and program models for dissemination and scaling, to craft in-depth studies of youth outcomes, and to identify what local and national opportunities may exist to deepen and broaden youth access and participation. (p. 2)

Thus, this study investigated OST STEM programs for K-12 females with a focus on contributing to the effort to map OST STEM programming.

Purpose and Significance to the Field

The purpose of this study is to extend previous OST research by investigating OST STEM programs for the subpopulation of females in grades kindergarten through 12. This research contributes to efforts to investigate OST programming by mapping a national sample of OST STEM programs for K-12 females. The findings from this study elaborate on aspects of program design, structure, content, funding, staffing and youth audience and thus strengthen knowledge of effective OST practices and the research base on OST STEM programming for females.

Chapter Two presented literature related to OST programming. This chapter noted the importance of understanding the scope and characteristics of OST STEM programming to serve as a foundation for conducting future research on best practices. Chapter Three describes the research methodology, sample(s), methods of data collection, and the analysis and synthesis of the data. The rationale for the choice of research design, data collection approaches, and data analysis are presented.

Chapter Three

Overview

In Chapter Two, literature related to OST programming was examined and presented. Key features of quality OST programs were described, including characteristics of quality OST programs, how OST quality is measured, youth leadership and participation, staffing and leadership, engagement and environment, relationships, support systems and links to the community, skill building, curriculum and standards. Chapter Two ended by noting the importance of understanding the scope and characteristics of OST STEM programming to serve as a foundation for conducting future research on best practices. This chapter describes the research design, data collection approaches, and data analysis. It is categorized into the following topics: research methodology, data collection, survey development, sampling and data analysis. Each section contains a description of the process and procedures used. Approval for surveying and interviewing research participants was obtained from the Institutional Review Board (IRB) of the University of Nevada, Reno before data were collected. See IRB approval in Appendix D.

Research Methodology

This study employs mixed methods. Based on a review of mixed-methods research definitions, Johnson, Onwuegbuzie, and Tuner (2007) conclude:

> Mixed methods research is an intellectual and practical synthesis based on qualitative and quantitative; it is the third methodological or research paradigm…it recognizes the importance of traditional quantitative and qualitative research but also offers a powerful third paradigm choice that often will provide the most informative, complete, balanced, and useful research. (p. 129)

Debate surrounding the usefulness of combining quantitative and qualitative research in the same study has existed since the 1960's (Creswell, 2003). Over time the methodology has increased in sophistication (Johnson et al., 2007). Journal articles, books, and funded projects reporting mixed-methods results have continued to increase over time (Creswell, 2003; Tashakkori & Creswell, 2007). Advocates assert quantitative and qualitative research methods each have stronger and weaker data-collection attributes and that combining them can thus counterbalance weaknesses (Creswell, 2003). Mixed-methods strategies vary, however, Tashakkori and Creswell (2007) broadly define mixed methods as "research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or program of inquiry" (p. 4). Johnson et al. (2007) illustrate the qualitative-quantitative continuum of mixed-methods research through the diagram that appears in figure four.

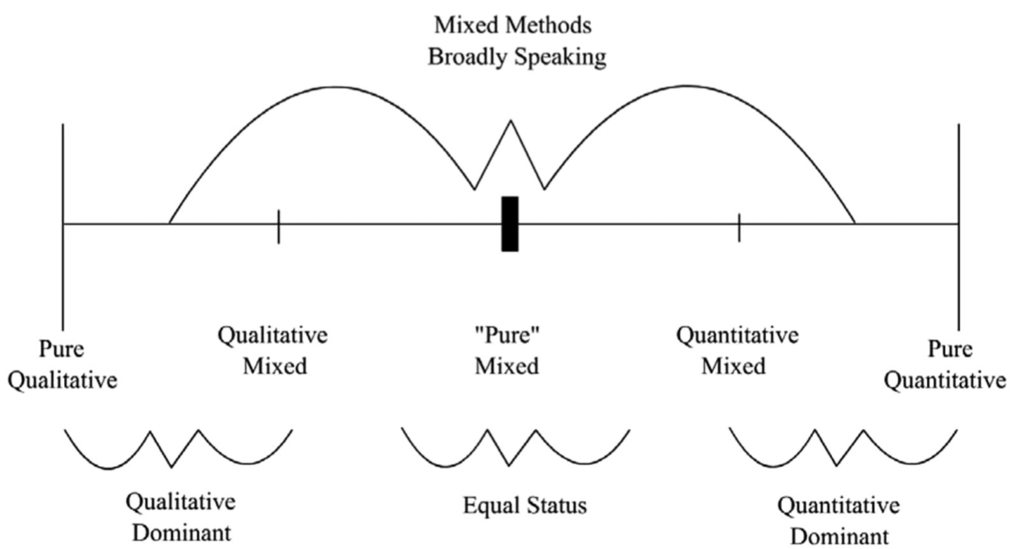

Figure 4: Continuum of different types of mixed-methods research (Johnson et al., 2007, p. 124).

Broadly speaking, "pure" mixed-methods research involves potential mixing at all stages of data collection and analysis. Further, "pure" mixed-methods research gives equal status to qualitative and quantitative approaches, with each informing the other (Johnson et al., 2007).

The specific mixed-methods research design employed in this study is a sequential exploratory strategy. Qualitative data were analyzed first and quantitative data were analyzed second (Creswell, 2003). The procedural notation is QUAL+quan. Johnson et al. (2007) explain,

> Qualitative dominant mixed methods research is the type of mixed research in which one relies on a qualitative, constructivist-poststructuralist-critical view of the research process, while concurrently recognizing that the addition of quantitative data and approaches are likely to [be of] benefit. (p. 124)

The purpose of this strategy is to use the quantitative data at the interpretation phase to assist interpretation (Creswell, 2003). Quantitative data are used to provide additional context and a richer description of the qualitative case (Creswell, Plano Clark, & Green, 2006). This approach allows researchers to triangulate data sources and to use varied data sources to answer different portions of the research question (Teddlie & Tashakkori, 2006). Teddlie and Tashakkori (2006) explain, “In the real world…a study may become a QUAL + quan study if the qualitative data become more important in understanding the phenomenon under study” (p. 13). Data collection included a program survey, in-depth semi-structured interviews and document and website content analysis.

Data Collection and Analysis

Website Search

Document and website reviews laid the groundwork for developing a categorization scheme of the features of OST STEM programs for females in grades kindergarten to twelve. Using websites, articles and white papers, a search for potential participants was conducted independently by two individuals, the researcher and another advanced doctoral student with experience in OST programming. Both researchers conducted their searches individually; lists were then combined to include both duplicates and programs found by a single researcher. Key terms such as “out-of-school-time”, “STEM”, “single-sex”, “single-gender”, “summer” and “after-school” were used. The websites were compiled through top hits on three major search engines that are used most frequently in the United States – msn.com, yahoo.com and google.com (Center for Media Research, 2006). This collection method also provided validity because users rely on search engines to seek information (Hye-Jin, Bae, Hove, & Yu, 2011). Search results were reviewed fom the top down because search engines tend to list sites by the webpage that best corresponds to the key words and/or in the order of the webpage most visited by users (Center for Media Research, 2006). The two individuals additionally searched websites, including the Association of Science and Technology Centers (ASTC), the Association of Zoos and Aquariums (AZA), the Coalition for Science Afterschool (CSAS), the National Girls Collaborative Project (NGCP), Harvard Family Research Project Database, National Summer Learning Association, Afterschool Alliance, The After-School Corporation, Afterschool.org, American Camp Association, the Out-of-School Time Resource Center, and the American Association of University Women (AAUW). The researcher identified as many OST STEM programs as possible for females in grades kindergarten to twelve based on the results from both searches. The website search identified programs that met the sampling criteria.

Website Review

Although all single-sex OST STEM programs were included in the survey sample, websites for review were further narrowed. Stand-alone websites were prioritized as opposed to OST STEM pages within a website that is not predominately devoted to OST STEM. Websites for review were screened by five criteria to include programs that:

- take place out of school time;
- focus on females only;
- focus on one or more of the STEM disciplines (self-defined);
- include youth in (or entering) grades K-12; and
- currently operate and have existed for longer than one year.

Only websites that met these criteria were reviewed. Social media pages such as Facebook were reviewed for programs that only had a social media presence. Based on these criteria, 115 websites were reviewed. The websites reviewed are listed in Appendix A.

Survey Development

The survey for this study was adapted from Thiry et al.'s (2012) Mapping Out-of-School-Time Science Survey. The initial survey included only questions regarding science, engineering and technology and was based on 40 interviews with OST program directors and then piloted with several program directors (Laursen, Thiry, Archie & Crane, 2013). The survey used in this study was adapted to add mathematics-related questions. For example, an item that asked "Does this program focus on a particular area within science, engineering or technology?" was modified to: "Does this program focus on a particular area within science, technology, engineering, or mathematics?" Thus, this survey assessed all STEM programs, including mathematics. The survey included 48 questions. Survey questions are a combination of open response and select-all-that-apply items. The survey additionally requested contact information for individuals willing to be contacted for a follow-up interview. The contact request came at the end of the survey. See the script and survey in appendix C. Feedback was sought from two individuals with experiences similar to that of the targeted research participants. Based on this feedback, the survey was revised. For example, an exemplar was added to clarify an item that was confusing.

Additionally, when asking about partnerships a clarification was added to differentiate between partners and funding sources. As with the original survey, the survey contained sections addressing:

- the organization's location and type, and the respondent's position within the organization;
- the organization's connections: partnering organizations, funding sources, involvement in national networks, and engagement in program evaluation;
- fit with the sampling criteria (see below);
- basic data about the program: its title and history;
- program audience: grade level, targeted group (e.g., girls, students with disabilities), application process, demographics;
- program structure: fee structure or stipends, scholarships, meeting schedule and frequency;
- program content: nature of staff, staff training, STEM content and activities; and
- any arrangement of programs into "ladders" or sequences for youth progressing in age and ability (Thiry et al., 2012).

Sampling

The survey sample was bound by five criteria to include programs that

- take place out of school time;
- focus on females only;
- focus on one or more of the STEM disciplines (self-defined);
- include youth in (or entering) grades K-12; and
- currently operate and have existed for longer than one year.

The focus on single-sex OST programming contributes to the effort to map subsections of the OST field (e.g., Porro, 2010; Thiry et al., 2012). Further, mathematics has been added to this study, addressing a field that previously was omitted from efforts to map the OST science, engineering and technology field (Laursen et al., 2013; Thiry et al., 2012). Including programs open to K-12 youth is purposeful given Dejarnette's (2012) suggestion of early exposure to STEM disciplines. Further, including elementary grades contributes to the previous attempts to map the OST field, which has focused on older youth with a college preparation focus (Laursen et al., 2013; Porro, 2010). Setting the inclusion criterion that programs must exist for longer than one year may yield higher-quality program participants. Longevity emphasizes Bodily et al.'s (2010) idea of a feedback loop, where positive experiences provide feedback that influences future attendance. When youth vote with their attendance, the continuation of programs implies some level of quality. Further, given the consistent funding concerns of non-federally funded programs, programs must continually advocate for funding by providing attendance and survey data with evidence that funds are used effectively (Bodily et al., 2010).

Following approval to conduct the study from the University of Nevada, Reno (UNR) Institutional Review Board (IRB), approved email scripts with links to the online survey instrument, hosted on SurveyMonkey, were emailed to OST program contacts found on websites. A total of 115 email invitations were sent to potential participants, with 109 of the email invitations being delivered successfully. Given that there are few agreed-upon titles for OST staffing, with Dennehy, Gannett, and Robbins (2006) finding that 350 survey respondents reported staff with 207 different titles, perceived program leaders were contacted regardless of title. Two reminder emails were sent prior to the end of the survey availability to increase response rate (Dillman, Hox, & de Leeuw, 2008). Possible interview participants' names and contact information were downloaded separately to separate identifiable information from survey responses. Given that more than six individuals consented to be interviewed, an effort was be made to represent a variety of programs geographically and across grade ranges. Interviewees were selected to represent a variety of STEM subject areas, type (e.g., after school, summer school), duration of program, and structure (e.g., single-site, multisite). Six interviews were conducted based on Guest, Bunce and Johnson's (2006) findings that methathemes are present with a data saturation of six interviews. Below are descriptions of the programs represented by the six interviewees:

	Interviewee (Pseudonym)	Grade Levels	Content	Format	Location
Program One	Ella	K-8	Technology and Engineering	Summer Camps of Various Lengths	Multiple States
Program Two	Perla	3-9	Engineering	1-week Summer Camps	Western State
Program Three	Suzanne	6-10	Mathematics	1-day Conference	Western State
Program Four	Jack	6-12	Engineering	1-day and 1-week Summer Programming	Eastern State
Program Five	Ana	7-12	Science	Afterschool Programming and Summer Camps	Midwestern State
Program Six	Tremaine	9-11	Science	1-week Summer Camp	Southern State

Figure 5: Programs represented in six follow-up interviews.

The six follow-up interviews were conducted by Skype. During the one-on-one interviews, participants were asked semi-structured questions. Participants were allowed to elaborate beyond the immediate question, and follow-up questions were asked to clarify or extend meaning. Interviews were audio recorded and transcribed. A full list of questions appears in appendix B. Sample questions include:

- Describe how you select your staff.
- Is your program evaluated? If so, how?
- How do you select the content in which your students engage?
- Is your camp a day or residential program and why?
- What ages of students do you target? Why do you target this age group?

The final data set includes survey results for 51 STEM programs from 30 states. These programs met all five sampling criteria and answered one or more questions. The response rate for the survey was 46.78%. Not all respondents answered every question, and thus, the sample size for each particular result varies. Response rate was calculated by dividing the number of programs that completed surveys by the number of programs that were contacted. This response rate exceeds the average response rate for electronic surveys, which range from 10-40%, with more detailed online surveys exhibiting lower response rates (Sauermann & Roach, 2013; Sheehan, 2001). Figure 6 shows the geographical distribution of survey respondents.

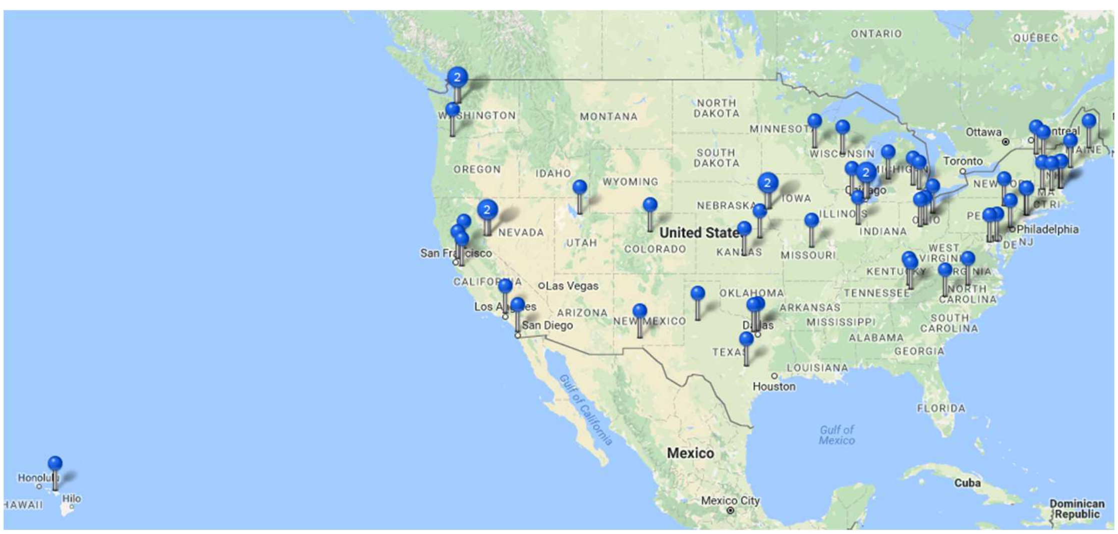

Figure 6: Geographical distribution of survey respondents.

Website Analysis

Stand-alone websites were analyzed using qualitative content analysis. White and Marsh (2006) explain that qualitative content analysis is inductive with open questions that guide the research. The researcher read through the website and reviewed it closely to identify concepts and patterns, knowing that not all concepts will be foreshadowed by the literature but are nevertheless important to consider (White & Marsh, 2006). The researcher was guided by the broad questions:

1. Do female K-12 OST STEM program websites describe a goal/mission of a program? If so, what?
2. Do female K-12 OST STEM program websites describe affiliations or partner organizations? If so, who are the affiliates and/or partners?
3. Do female K-12 OST STEM program websites describe recruitment, application and/or acceptance procedures? If so, what are these procedures?
4. Do female K-12 OST STEM program websites describe their staff? If so, who are their staff?

Analysis required deep grounding in the data. Counts are presented as descriptions of specific cases, such as the percent of websites reviewed that reported staffing information (White & Marsh, 2006). All website information was compiled by research question, for example, the researcher compiled all information from websites on the topic of mission and goals prior to analyzing this data. Once website information was compiled the researcher proceeded through the coding process by analyzing the data line-by-line and paragraph-by-paragraph and then coding the deconstructed fragments (Lichtman, 2012). Codes were then compared, renamed, added, or deleted as the researcher constantly compared them (Corbin & Strauss, 2008).

Survey and Interview Analysis

Survey responses were downloaded separately from respondents' identifiable information. Survey information was compiled, and quantitative and qualitative data were separated for analysis. Each interview was audio recorded and lasted 20-40 minutes. Qualitative data for both surveys and interviews were analyzed first. Line-by-line open coding was used to analyze written responses to the open-response questions and the Skype interviews. The researcher proceeded through the coding process by analyzing the data line-by-line and paragraph-by-paragraph and then coding the deconstructed fragments (Lichtman, 2012). Through comparing and contrasting, the researcher asked how statements were similar to or different from the previous and following statements. Codes were compared, renamed, added, or deleted as the researcher constantly compared them (Corbin & Strauss, 2008). The researcher generated themes based on these combinations of codes. Using quantitative from the survey such as demographics and multiple select items, descriptive statistics were calculated to include frequency counts, percentages, and measures of central tendency.

Limitations of the Study

The results of this study represent a sample of programs that met the following five criteria: take place out of school time; focus on females only; focus on one or more of the STEM disciplines (self-defined); include youth in (or entering) grades K-12; and currently operate and have existed for longer than one year. Recruiting programs that met these criteria posed logistical and methodological challenges. There is no single network of OST programs in the United States from which to sample nor was there a reliable method to find small programs operating without a web presence and without affiliation with a larger OST organization (Thiry, et al., 2015). Despite two individuals independently conducting extensive Internet and literature searches, the sample of programs is more likely to include larger, well-connected programs with an online presence. Additionally, the surveys and interviews used in this study relied on self-reported data.

Chapter Four

Chapter Three included research methodology, data collection, survey development, sampling and data analysis. Chapter Four presents the research findings. Typical program mission and goals, staffing decisions, scheduling and partnerships are presented. Further, findings regarding how programs for K-12 females differ according to curriculum, content, application process, population, program evaluation and costs are presented. Finally, findings are presented on what program leaders report as important for a high-quality program and what program leaders report as challenges to implementation.

Results

This study examined the following research questions for K-12 OST STEM programs for females conducted in the United States:

1. What are the most common features of OST STEM programs for K-12 females in terms of such aspects as curriculum, population served, program evaluation and cost to participants?
2. What are typical program goals, staffing decisions and program designs for K-12 OST STEM programs for females conducted in the United States?
3. What do program leaders report as important elements for a quality program?
4. What do program leaders report as challenges in implementing their program?

Results are reported from the qualitative content analysis of 115 program websites, mixed-methods analysis of 51 survey responses, and qualitative analysis of six semi-structured interviews.

Survey responses represented programs from 30 states. Website reviews represented programs from 38 states. Figure 7 shows the geographical distribution of programs whose website was reviewed.

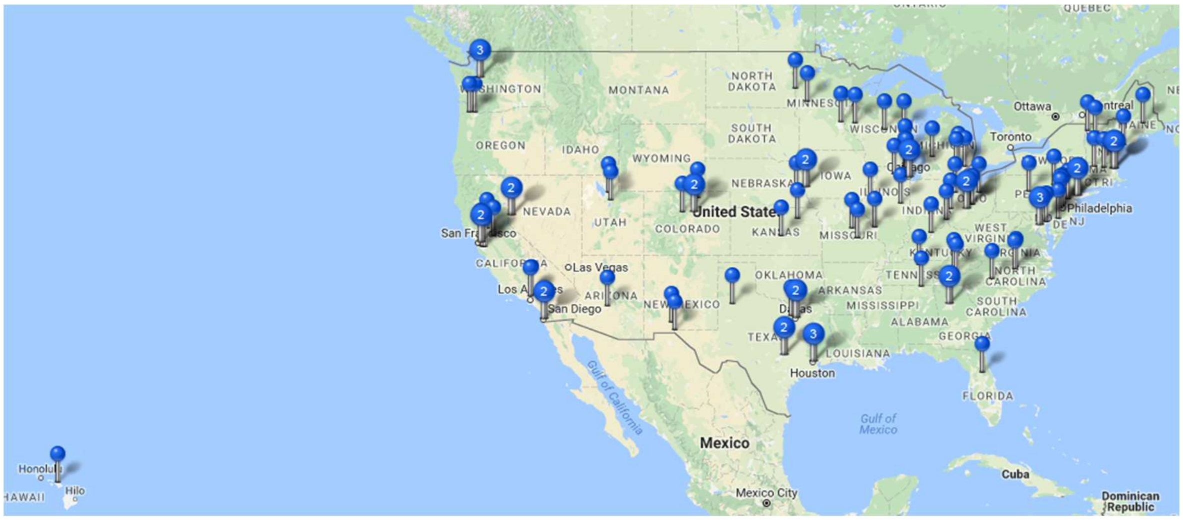

Figure 7. Geographical distribution of K-12 OST programs for females website reviews.

Figure 8 aligns the research questions for this study (1-4), the source of the data to inform them, and the corresponding indicator(s).

Research Question	Data Source(s)	Indicator(s)
1. What are the most common features of OST STEM programs for K-12 females in terms of such aspects as curriculum, population served, program evaluation and cost to participants? 2. What are typical program goals, staffing decisions and program designs for K-12 OST STEM programs for females conducted in the United States?	• Website Review • Surveys • Interviews	• Goal/mission • Affiliations or partner organizations • Application and acceptance • Staff descriptions • Academic Content • Partner organizations and their role • Grade level(s) served • Other participation criteria (e.g., gifted) • Youth acceptance criteria • Demographic information • Fee structures • Schedule • Program evaluation • Professional networks
3. What do program leaders report as important elements for a quality program?	• Interviews	• What do you identify as key elements for a quality program?
4. What do program leaders report as challenges in implementing their program?	• Interviews	• Have you faced any challenges in implementing your program, if so, what?

Figure 8: Research question alignment with data-collection methods and data indicators.

Research Question One

What are the most common features of OST STEM programs for K-12 females in terms of such aspects as curriculum, population served, program evaluation and cost to participants?

Content and Curriculum

Field of Study

Content and/or curriculum were addressed in 115 of 115 websites reviewed, 50 of 51 completed surveys and six interviews. All programs had a focus on at least one STEM discipline. Survey respondents report a relatively equal emphasis in the STEM disciplines overall.

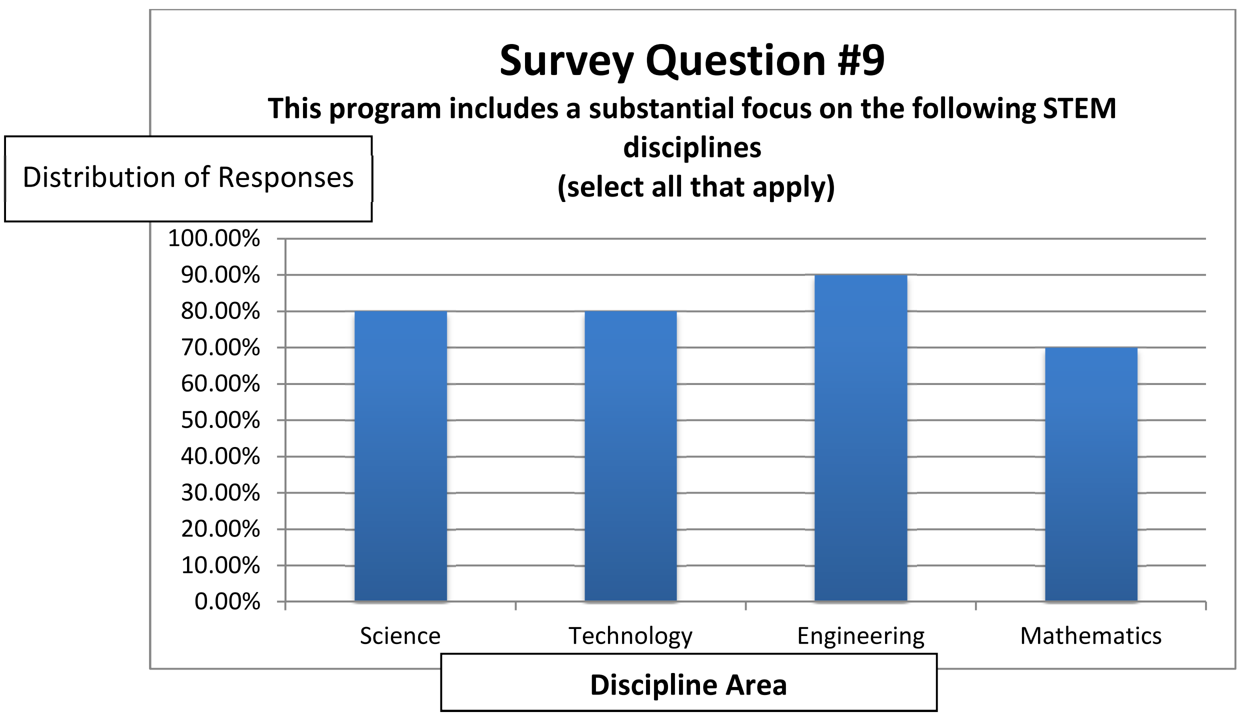

Figure 9: Predominant content areas of OST STEM programs for females.

However, responses to the survey question “Does this program focus on a particular area within science, technology, engineering or mathematics (e.g., statistics, robotics, astronomy)?” received responses in fields of science, technology, and engineering, but not mathematics. Similarly, only

11.3% of websites include mathematics as a content area for instruction. When asked specifically in interviews about the “m” in STEM, the interviewee for program two answered, “Sure, we have to apply math to do the science.” The director of program four explained, “Engineering is really an applied science. So we will do a module that may talk about helicopters and flights…then talk about rotation but then we will do probability and statistics of how many times you can hit a target.” Programs tend to self-report mathematics as a content area, although it is most likely to be integrated into instruction rather than being a focus content of instruction.

Content Source or Design

Programs vary in the level of formality in content design or acquisition. Program directors indicated that it is common to receive pre-designed or “canned” curriculum through a partner such as SciGirls. SciGirls is affiliated with PBS and is funded by the National Science Foundation to provide STEM resources for females. These open source materials are available online. Other interviewees reported using curriculum from a local institution of higher education. In an interview one director described a partnership with a local university, which included curriculum development by professors in the school of education.

Some programs opt to design their own programs through a formal process. The camp director from program one explained,

> We use our student and parent surveys to ask what their children are interested in and ask the students what they want to learn. Then we use the extensive research, for example, that girls like to feel that they can make a difference, and then combine that to make our curriculum on citizen science and sustainability.

The director of program six stated the role of research literature in her formal curriculum development process, saying:

> [We add elements] based on what we have read in the literature about things that are good for females. We feel that programming is a very important concept for anyone to be STEM literate in the future so we have some graphical programming and some exercises to practice their graphical visualization skills.

The director reported that this program focused on visual-spatial reasoning skills due to research showing that girls have weaker spatial skills. The instruction described is based on research that these skills can be taught and are not fixed.

The director of program four explained the curriculum vetting process. First, STEM professionals design new modules or prototypes. Then these prototypes are field tested with older, high school interns who provide feedback for revision prior to camp implementation with middle school girls. This program director did not provide additional specific information about the piloting process, but elaborated that the high school interns are comprised of prior middle school campers who help to choose the most interesting and engaging lessons to share with middle school students.

More commonly, however, camp directors in interviews explained an informal process of content development. The director of program two said, "Honestly, it was just myself and a couple of teachers who just came up with an idea and ran with it." Further, the coordinator of program five described her process of planning field trips and workshops by saying, "I just try to be really creative. I just put out a Facebook post asking my own friends for creative ideas for unique STEM fields that I'm not thinking of and I got some really good leads." Additionally, the director of program three explained, "We really rely on our teachers. We give them some big ideas, like to teach geometry in a hands-on way, but they do all of their own planning." Although some programs attempt to use research-based or previously piloted content, programs in this sample show great variety in both process and product.

Content Alignment

Chosen content or topics predominantly align with the themes expressed in mission statements (e.g., interest, exposure, college and career, dispositions) rather than to particular standards or benchmarks. Directors report selecting their content based on what they believe will be interesting to the girls. For example, the director of program three reported eliminating a keynote speaker at their conference because girls in the past did not seem to be interested. The program gauged this interest level through observations and survey feedback. The coordinator of program five reported asking girls what they find interesting and then helping them "find the STEM" in whatever they suggest. Program four, however, focused on exposure, "It's actually a broad brush. All science and engineering fields might be represented." Programs focused on college and career readiness were more likely to have particular content or standards. For example, program six, with the mission of increasing readiness for college level physics aligned content to AP physics standards. In addition to content, programs with a focus on dispositions include curriculum on gender equity, stereotype threat and growth mindset. Finally, a program whose mission is to "Inspire girls to be strong, smart and bold" has a curriculum that includes 50% STEM, 25% physical fitness and 25% personal development. The program coordinator explained that part of accomplishing their mission is to include content educating young women about their bodies.

Demographics of Program Participants

Demographics of program participants were addressed in 48 of 51 completed surveys and six interviews. Participant demographics were not found in website reviews.

Race and Ethnicity

All-female programs collect demographic data related to gender and age or academic grade to ensure participation eligibility. Race and ethnicity demographics are tracked by 66% of programs. The most common method is requesting self-reported data on application or registration forms. Many programs ask students to voluntarily identify their race or ethnicity, which results in incomplete data sets. Some programs receive demographic information from school district partnerships. The remaining 33% of programs do not track demographic information. The coordinator of program five explained, “I get very little information, just their name and what school they go to.” The table below presents the average percentage of program participation by ethnicity. These average percentages are as reported by respondents and do not total 100%.

Table 1

Program Participation by Ethnicity: Results from Survey

Ethnicity	Mean Percent of Program Participants	Highest Percent	Lowest Percent
African American or Black	21.2%	85%	.1%
American Indian or Alaska Native	2.8%	25%	0%
Asian or Pacific Islander	10.4%	50%	0%
Caucasian or White	49.2%	95%	1%
Hispanic or Latina	16.6%	75%	.1%
Multi-racial	4.9%	7%	0%
Other	3.6%	8.5%	0%

Grade Levels Served

Programs in the sample serve girls in grades kindergarten to twelve. Middle school girls represent the most commonly served grade levels. All six interviewees referenced the need for middle school programs, regardless of the grades they chose to serve. Half of the interviewees served middle-grades girls and cited research from programs such as Eureka and SciGirls calling attention to this age range as the "critical juncture that determines whether or not girls pursue more challenging math and science courses." Two of the program directors interviewed served elementary-grades girls. One explained that initially both elementary and middle school girls were recruited, but they learned that middle school girls had unique needs and chose to only continue an elementary program based on the strengths of their staff. The elementary director for program two explained motivation for a program that admitted students beginning in the third grade: “Third grade is a good time to really try and change a mindset, maybe try to change it so we do not have that drop when they get to middle school.” The director of program six explained targeting of the high school age group: “I think middle school programs are important, but if all we did was programs for middle school and nothing at the high school level we would still have a lot of girls dropping out.” Figure 10 shows that the majority of programs serve girls in the middle grades, with the smallest population being K-3 girls.

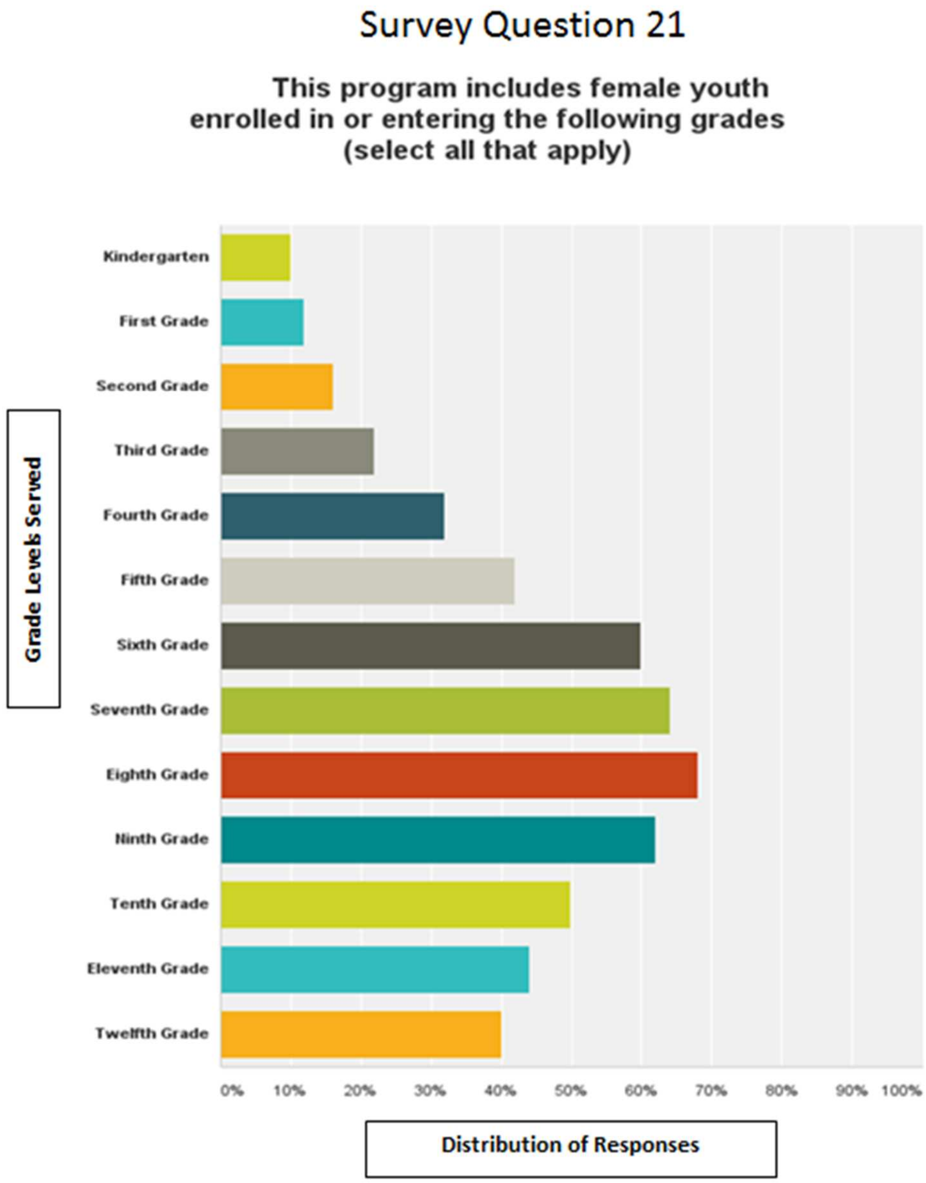

Figure 10. Grade levels served in OST STEM programs for K-12 females.

Application and Acceptance

Application and acceptance was addressed in 91 of 115 websites reviewed, 34 of 51 completed surveys and six interviews. Applications vary by restrictions, criteria and methods of selecting applicants.

Application

All programs include some restrictions for applicants. For example, all programs specify particular age, grade ranges or students with particular prerequisite coursework that are required to apply to the program. Additionally, many programs specify geographic restrictions, only admitting students from particular states, school districts, or schools. Some competitive programs do not have open applications, but are available by invitation only. Survey results indicate that most programs open applications to all females in the appropriate age or grade range.

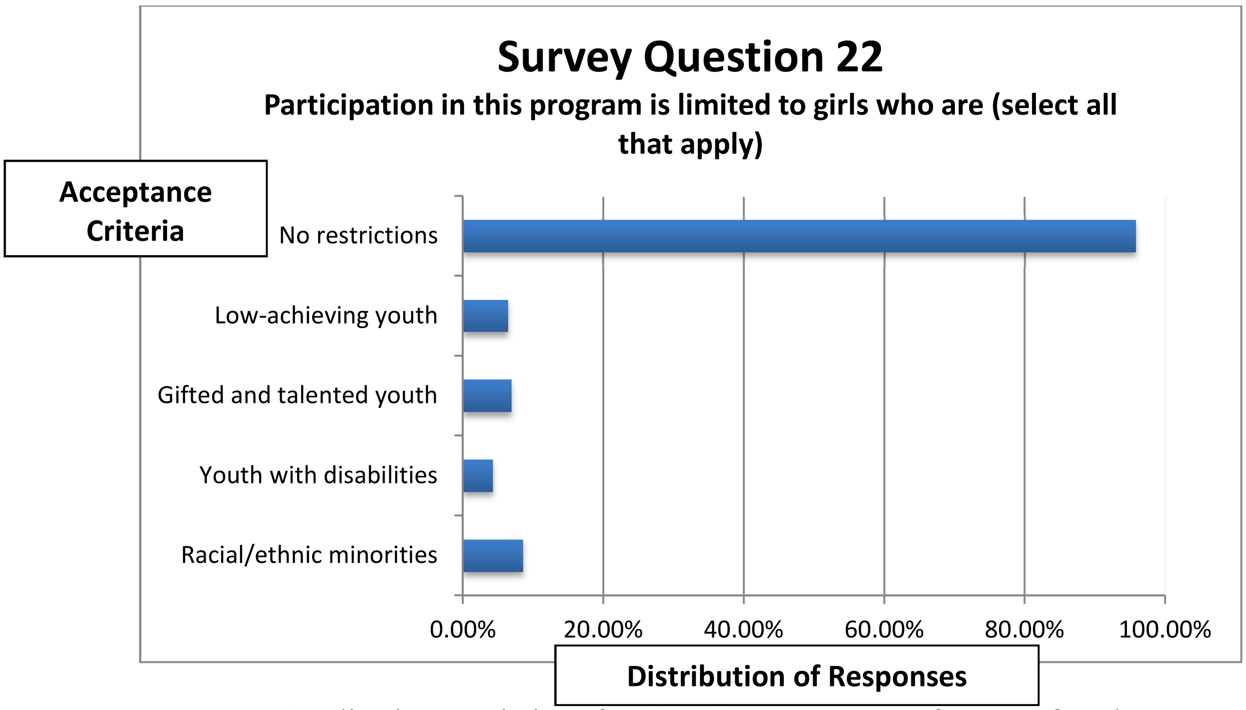

Figure 11. Application restrictions for OST STEM programs for K-12 females.

Acceptance Criteria

Programs use various criteria for selecting students to participate in programs.

Table 2

Criteria for Acceptance to OST STEM Programs for Females: Results from Website Review

Acceptance Criteria	Percent of Programs
No Criteria	45.1%
Merit	24.2%
Interest	12.1%
Diversity	6.6%
Combination	12.1%

The majority of programs have no restrictions once an application is submitted. For example, in survey responses, camp directors describe these limited requirements saying, "We wish to enroll every girl in the Portland Metro Area," "No other criteria for acceptance is required besides completing an application and a small fee," and "We have always admitted all students that applied." For programs that have no restrictions but more applicants than open slots, program directors report using either a first-come, first-served protocol or implementing a lottery system to randomly select applicants.

About one-fourth of surveyed programs are merit based, specifically admitting students on a competitive basis based on test scores, academic transcripts, or teacher recommendations. One program describes how applicants with the highest American Mathematics Competition test scores on the AIME are accepted. Teacher recommendations are collected in some program application processes. Some report the use of letters of recommendations to provide teachers' perception of students' academic preparedness for particular STEM content.

Teacher recommendations are also collected as an indication of teachers' perceptions of student interest, which is also assessed through student essays. One program requires participant responses to these essay prompts:

> Why do you want to participate in the STEM Summer Institute for Girls? What is it about the description of the program that excites you? What parts of science, technology, engineering, and mathematics do you already enjoy? What are some examples of how you have worked well in a team in one of your classes?

In an interview, the director of program five explained the screening process for interested students:

> We only accept girls who are really interested because they have to commit to a five-year program. We do interviews with the girls and their parents and we have a letter of recommendation that has to be sent with a report card. That shows that she can get a letter of recommendation, get her report card, come to an interview, and write an essay. If the girl can do all of that, then she is pretty interested and we let her into the program.

Other programs accept applicants using an equity model, specifically admitting girls based on demographic information. The director of program one explains, "We have a hybrid model, so we have high wealth and high poverty. We accept 60% of girls who pay full tuition and 40% of girls who pay nothing." Another programs website describes purposeful acceptance of "girls from underrepresented groups." This program specifically seeks to accept Latinas and girls in poverty. Criteria for programs implementing an equity model vary based on the mission of the program but are designed to increase access for students of low SES and underrepresented groups of females.

Many programs use a combination of criteria. For example, one program specifically targets inner-city girls attending Title One schools who are high-achieving, high-potential girls on track for AP physics. This program is both merit-based and diversity-minded.

Program Evaluation

Program evaluation was addressed by 45 of 51 completed surveys and six interviews. The majority of programs (88.7%) conduct internal evaluations. Three program directors described their internal program evaluation efforts, which differ by program:

- Last year we did a pre and post survey for each of our day programs for both the participants as well as the parents of the participants. We would also ask our volunteer mentors to complete that survey so we could ask them things such as their confidence level in STEM subjects. (Program Two)
- We do impact assessments that are self-assessments by the attendee. In some cases they are pre-post. In most cases they are looking at attributes that we consider important like the level of confidence or desire to continue in STEM activities. (Program Six)
- We have multiple evaluations. We have pre and post surveys for attitudes and we also test their knowledge pre and post for physics concepts. Then we also track the students and identify the girls who go on to take AP physics. We compare the girls that take AP physics and attended the camp to the girls who take AP physics and did not attend the camp but are in the same school district. We have tracked that data for fourteen or sixteen years now. (Program Six)

Many internal evaluations used a pre/post model that collects data on participants. Program directors did not report these internal evaluations as collecting data on families or staff. Additionally, reported evaluation efforts are short-term, being conducted during the program without intentions for longitudinal follow-up.

External evaluations are conducted by individuals outside the organizations for 26.7% of programs. One program director explained two external evaluations.

> We partnered with Harvard Medical School to observe and rank us on dimensions of successful programs…the twelve markers of what makes a quality afterschool program. We also partnered with a local university to run our site evaluations. They do the DST, the Draw the Scientist Test and the university created a survey to do at the beginning and end of our program and a parent survey. (Program One)

Some programs employ a combination of internal and external program evaluations. The director of program five described this combination for her program. The internal evaluation measures students' self-reported self-confidence, self-efficacy, academic motivation and healthy eating habits through surveys. She noted, "The University of Nebraska Omaha is also evaluating our program…they're tracking girls once they graduate high school to see if our program is effective [because] our first cohort will graduate this spring."

Some program leaders surveyed did not report the use of evaluation procedures (13.3%), or a plan to develop an evaluation system. 11.1% of survey respondents indicate they are in the process of developing an evaluation system. The director of program three explained the perceived need for a program evaluation and the program's current efforts:

> We are working on our evaluations to try and facilitate a way to track and measure return participants…[it's] something we need to look at more. But we have had some

> undergraduate mentors that actually started off in our program and learned what they want to do by participating in our program.

Program evaluation efforts reported in both survey responses and interviews represent a wide scope of efforts involving various types of internal and external evaluations with some programs in the process of developing program evaluation and developing beginning attempts to track participants longitudinally.

Costs and Financial Assistance

Fees

Fee structure was addressed by 50 of 51 completed surveys. Specific costs were described in 34 of 51 completed surveys. Most programs (66%) require participants to pay a fee to participate in the program, such as an application fee. Other programs (31%) allow youth to participate in the program at no cost. One no-cost program further reports using a monetary incentive in which participants receive a stipend to participate in an internship program. Reported participation costs vary from $1 per day to $5,800 for a four-week program. Table 5 shows the distribution of the one-day cost paid by a participant without a scholarship. For multiday camps this was calculated by dividing the total cost by the number of days.

Table 3

Non-Scholarship Participant Cost for One Day of Participation

Cost Per Day	Percent of Programs
No Cost	8.8%
$1-$30	23.5%
$31-$60	29.4%
$61-$90	23.5%
Greater than $90	14.7%

Some costs vary by geographic location. For example, one multisite program charges $390 in North Carolina and $725 in California for the same one-week camp. Additionally, some variations in cost appear to relate to overnight costs. One program charges $15 per day for its day camps but $57.50 per day for its overnight camps. Program costs can also vary based on subsidies and grant funding. One program director explained that participants attend at no cost during years when there is grant funding but pay tuition during years without grant funding.

Scholarships

Programs often provide scholarships to participants: 77.8% provide full scholarships to some participants and 55.6% offer partial scholarships to some participants. Few programs (5.6%) offer no financial assistance. All scholarships are based on financial need. Programs evaluate this need in various ways. Some programs require documentation of financial need such as evidence of free lunch eligibility or qualification for food stamps. Other programs provide scholarships to any students who request financial assistance. One program with an open scholarship program reported that approximately 70% of participants use their tuition waiver. No respondents reported merit scholarships available to high-SES students.

Research Question Two

What are typical program goals, staffing decisions and program designs for K-12 OST STEM programs for females conducted in the United States?

Mission and Goals

Missions and goals were addressed in 84 of the 115 program websites reviewed. The following nine themes emerged: inspiration (41.7%), college and career (31.0%), exposure (23.8%), dispositions (19.0%), role models (17.9%), skills and knowledge (15.5%), leadership (11.9%), gender gap (10.7%), and diversity (9.5%). The mission statement below demonstrates one that could include multiple themes.

> *Our mission is to support and encourage girls from varied backgrounds to increase their knowledge, skills, and confidence in mathematics, as well as technology use for mathematics learning. The program provides learning opportunities, resources, and participation in a community of support that better prepares girls to enhance the quality of their academic, vocational, and everyday lives and to contribute to advancement of the wider society.* (Northern Nevada Girls Math and Technology Program, n.d.)

When mission and goals were discussed in interviews, these themes were also prevalent. Most commonly, mission statements include a goal of inspiring or exciting girls to build interest or curiosity. The director of program two elaborated, "Really, the mission as a whole is to inspire and encourage girls in STEM so hopefully they will continue to explore…science or technology and then consider a career down the road or in their college experience." The idea of supporting STEM college and/or career decisions was the second most commonly mentioned theme in mission statements. Some programs go farther, with a mission to bridge the K-12 to college transition by providing assistance with college applications, or helping youth and their parents understand requirements they might need in the future.

The third and fourth most common themes support college and career decisions through providing exposure to STEM fields or addressing dispositions such as self-efficacy. The interviewee for program five described the mission of her program as: “to expose girls to as many different STEM fields as possible with the hope that they will then choose a STEM career when they graduate.” The director of program three described the fifth most common theme, role models, saying, “We are wanting to build a community of not only female STEM scientists, but also STEM female enthusiasts.” Other prominent themes include increasing skills and knowledge and providing opportunities for leadership. For one camp, building skills and knowledge includes preparing high school juniors for pre-advanced placement (AP) physics classes in high school. The camp director of program six noted, “The philosophy of the camp is to take high potential girls…and help them to do really well in pre-AP physics because usually the girls hit the wall in physics.” This camp also expressed intent to address the gender gap. The pre-AP physics program was founded to address “the biggest gender gap for girls in [the] school district.” Diversity was only mentioned by two respondents, suggesting that diversity was not a main program mission. The director of program five elaborated, “We are trying to get more women in STEM, especially women who are minorities. Our program is comprised of African American women and we have some Latina young women.” The director of program one explained their specific goal of exposing Latina girls to their college campus, saying, “Often Latina families don’t want their children to leave the neighborhood so they’ve never been to the school. [We want to show] your daughter can still live at home and go to college.” Although not a mission or goal, another common element of mission statements was the method of using "hands-on" teaching to accomplish goals. Specifically, 23.8% of mission statements include this pedagogical strategy in their mission statement.

Staffing Decisions

Staffing was addressed in 33 of 115 websites reviewed, 47 of 51 completed surveys and six interviews.

Gender

Same-gender, single-sex staffing is used for 66.7% of the programs and co-educational staffing in 21.2%, with 12.1% of programs not being gender-specific when describing staffing. The director of program one described her choice of hiring an all-female staff as follows:

> Because it's a program that is centered around all girls we really want a community of like-minded females. We want our young girls seeing our older girls excelling, seeing our college girls excelling, seeing our teachers excelling and we just want to protect that really close all girl environment.

Similarly, the director of program two explained, "Having mentors and educators that they can relate to is a driving factor. So we thought that if we were doing an all-girls camp it would make sense to do the same for the educators." The director of program six, with a co-educational staff, described her staffing choices thus: "We try to have at least one female teacher in each session. We have a few male teachers, but both of them have been through gender equity training. We certainly need male advocates for women in STEM." Another director specified that they have male staff helping with the program, but only "behind the scenes" or in supporting roles such as taking photos or videos.

Staff Background

The following are the most common classifications of staff members described on program websites. Programs are most likely to hire college students (42.4%), STEM university and faculty (30.3%), K-12 teachers (30.3%), STEM industry professionals (24.2%), and social science university faculty (18.2%). Survey results mirror high percentages of staff members from STEM disciplines: 75% of programs responded that "most or all" of the staff have a background in STEM disciplines, whereas only 42.4% of programs responded that "most or all" of the staff have a background in education or youth development. Most programs hire a combination of employees to fulfill different roles. For example, one program hires STEM university faculty to write the curriculum and K-12 teachers to deliver the content to the students. The director of program one elaborated, "We have a few different types of staff members. We have college fellows, STEM teachers and we bring in role models that are women that are exceeding in their careers." In addition to variety in the qualifications of staff, there is also variety in the contract types offered to staff.

Permanent Staff and Volunteers

Based on survey responses, permanent staff are uncommon in programs, with only 27.1% of survey respondents reporting that "most or all" staff are permanent and paid. A program director from one of these organizations explained that their OST STEM program for K-12 females is just one of many programs in an outdoor education school. Due to the joint affiliation, the eight full-time staff members lead outdoor programs for school groups in addition to the all-female OST program. More often, respondents report a reliance on seasonal or part-time staffing (72.9%). This is particularly true for programs that are not affiliated with a larger institution with infrastructure. The director of program two stated, "We have a variety of what we call short-term or contract instructors who live in the community and come from the background of science." Many respondents report also relying on volunteers (76.6%). The director of program three comprised of "most or all" volunteers explained, "We have a few committee members who've received a stipend but we realistically are powered by volunteers." This university-based program recruits volunteers through undergraduate and graduate student organizations. The director elaborated that it would not be possible to run their program without volunteer college undergraduate mentors in STEM disciplines.

Scheduling

Scheduling was addressed in 47 of the 51 completed surveys and in six interviews. Programs are more likely to be commuter (day) programs (70.2%) than residential (overnight) programs (29.8%). Day programs cite various reasons for their day-only scheduling, for example, the young age of participants they serve, lack of space and lack of necessity when serving the immediate neighborhood. The director of program one explained, "We did our research. There were other programs that were 9-12 or 9-3, but there was a lack of programs to accommodate working families in our neighborhood." In response to this research, the program created hours that began earlier in the morning and lasted later into the evening to mirror common work schedules. Additionally, programs that take place on military property, such as the Navy and NASA properties, commented that security protocols do not allow participants to stay on site overnight. Residential programs state an ability to offer recreation and reducing transportation needs for participants and their families as reasons for their format. Variation in duration of residential and day-programs will be discussed later in this chapter.

When Programs Are Offered

OST programs are typically offered after school, during the summer, or a combination of the two. Survey respondents report operating on a set schedule, rather than providing drop-in times chosen by youth. OST STEM programs for females are more likely to be offered during the summer (73.8%) than the academic year (22.7%). Few respondents report offering a combination of both summer and academic year programming (3.5%). All summer program schedules report full-day programming and vary from four days to one month in length. One-week summer camps are the most common. Some programs offer multiple one-week summer camps and youth can choose to attend multiple camps in the same summer. The prevalence of summer programming might represent intent to increase participation. The director of program five explained that summer programs are much more successful than after-school programming because "we have 100% participation in the summer camp and the summer externships." The director went on to describe challenges with participation during the school year due to competing extracurricular activities such as sports.

Academic year programs vary from one-hour, after-school clubs to full-day Saturday programming. These programs range in frequency from one day per year to all weekdays afterschool. The Expanding Your Horizons conference schedule is representative of the one full day per year STEM conference format. Combination programs offer a combination of after-school and summer programming. In a survey response, one survey respondent described their combination program this way:

> During the fall semester 50 sixth grade girls come to the campus once a month to do two WEBS labs. During the spring semester, 50 sixth grade girls from different local schools come to campus once a month to do two WEBS labs. Then for the summer camp,

approximately 90 7th and 8th grade girls come to the campus for seven days to do a variety of labs in the sciences.

Total Hours

Survey respondents reported the total number of contact hours per year for a typical participant who completed the program. Total hours ranged from 5 to 350 hours per year. Most programs offer a total of 10 to 49 contact hours per year. This corresponds with the prevalence of one-week summer camps.

Table 4

Student Contact Hours Per Year: Results from Survey

Total Number of Contact Hours Per Year	Percent of Programs
Less than 10 hours	16.21%
10-49 hours	43.24%
50-100 hours	18.92%
Greater than 100 hours	21.62%

Recreation

Some programs implement non-academic leisure or recreational times for students. These activities vary from structured non-academic field trips to supervised free time outdoors. Residential programs are more likely than day programs to report scheduling of separate recreation time, citing the goals of building community and building relationships between role models and students. Day programs that include recreation components related this choice to their mission statements:

> Our recreation is a part of our goal for physical health. During the first two years the girls participate in an hour and a half of some type of sport every day at camp and it changes. We do wheelchair basketball, rock climbing, swimming, kayaking…. During the year

we'll go on hikes, we'll take the girls to the challenge course. We give them access to different recreation opportunities that they might not typically have, as they are from the inner city. (Program Five)

Although they do not offer a specific recreation program, most day programs incorporated recreation into programming decisions with a goal of keeping students active. The director of program one explained, "We know that they have been in a classroom setting for three hours or so and need a chance to run around…so if we are studying force and motion we will do a force and motion PE activity." Similarly, the director of program four commented, "There is a high level of activity built into things like a scavenger hunt or space race, so recreation is built in, but there is not a separate set period for that." Although not necessarily separate recreation, most programs specified attention to physical activity or the pedagogical practice of incorporating movement into instruction.

Affiliations

To gather information on affiliations, websites were reviewed for lists of sponsors and partner organizations. Partners, affiliates, or supporters were addressed in 69 of 115 websites reviewed. Partnerships were identified in ten categories for programs. Percentages do not total 100% because some programs participate in more than one partnership type. Industry and institutions of higher education are the most common partners.

Table 5

Partnership Types for OST STEM Programs for Females: Results from Website Reviews

Partnership Type	Percent of Programs
Industry (e.g., Yahoo!, Apple, International Game Technology)	68.1%
Higher Education Institutions	42.0%
Foundations	33.3%
Federal Public Partners (e.g., NSF, NASA, 21st Century)	20.3%
Women's Group (e.g., AAUW, Society of Women Engineers, National Center for Women and Informational Technology)	18.8%
STEM Groups (e.g., Society of Civil Engineers, The Mathematical Association of America)	14.5%
Individual Donors	11.6%
OST Groups (e.g., SciGirls, Girls Inc., Afterschool Alliance)	11.6%
Local Public Partners (e.g., school district, Department of Children and Youth)	10.1%
Museums, Science Centers, Zoos	7.2%

Although some partnerships are solely related to funding, respondents indicate that partnerships provide more than money to OST STEM programs for females. For example, programs that partner with the OST group SciGirls use the curriculum and research provided by this organization. Partnerships with schools and teachers are common for practical purposes. The director of program three described the role of partnerships with teachers in registration and transportation:

> The teacher works and registers all of her girls and we try and coordinate throughout counties so that we're partnering with teachers in all the regions…they're able to help with the effort of organizing all of the girls and filling all of the busses.

Two other non-profit OST program directors described the value of a partnership with higher education for program evaluation. These partnerships provided observers to conduct external evaluations, design student evaluations and better evaluation metrics, and analyze evaluation results. Other partners provide novel experiences and field trips for the girls, such as field trips to Frito-Lay and Otterbox. The coordinator of program five explained how a program's history and reputation contributes to partnerships:

> We are pretty well established so when we are reaching out to businesses they trust us. They get to go on all these different field trips and in the third and fourth year of our program the girls do an externship outside in local businesses.

Externships in this program allowed for older, returning participants to complete a summer externship in a STEM-related field. For example, girls worked with NASA on robotic engineering projects and one girl who was particularly interested in large animals completed an externship with a local veterinary clinic.

Survey responses indicate that most commonly, partners provide guest speakers, mentors and role models. One survey respondent illustrates this by saying, "Presenters from over 25 academic, private industry and other organizations provided hands-on workshops, including BIOCOM, City of San Diego Public Utilities Department, Qualcomm, Reuben H. Fleet Science Center, Sea World, Sempra Energy, the University of California, San Diego, U.S. Navy, San Diego State University, Ocean Discovery Institute and more!" The graph below reflects the survey responses of the reported roles of partners.

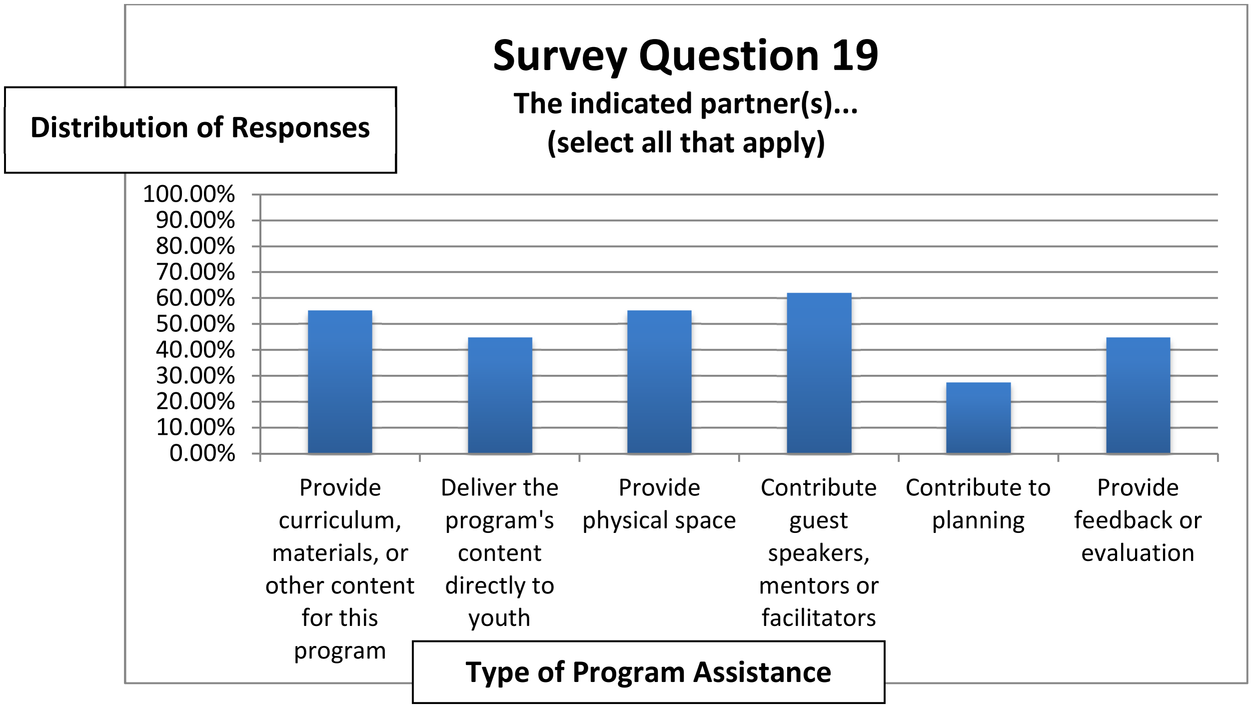

Figure 12: Contributions of OST program partners.

Professional Networks

As noted, 11.6% of programs in the sample partnered with OST professional networks such as SciGirls and Girls Incorporated. Programs affiliated with these groups tend to be multisite. Levels of control and autonomy vary by partnership. For example, Eureka Camps, affiliated with Girls Inc., have 21 locations. In an interview, a coordinator of one Eureka Camp explained the key roles of this partnership, including evaluation, recruitment, funding, transportation, and staffing. She elaborated on the specific resources, saying that Girls Inc. provides a manual with research-based directions for starting, running and sustaining a Eureka program but that each location has the flexibility to make programmatic decisions based on the needs of their population and location. Similarly, Expanding your Horizons has over 100 registered conferences worldwide. A director of one conference explained, “Every conference can design its own format as long as they have some of the key elements. We are joining another group too to offer a new STEM café and it's the same thing, you have to offer a few key things." Additionally, a program with four locations and partnered with SciGirls described the perceived benefits of this partnership, "We really benefit from their research and their curriculum to stay on top of current trends and best practices." Serving as one site in a large affiliation, however, is not without challenges. One respondent added that there is a limited amount of funding so "we only get a certain amount because we are just one program of many." Additionally, interviewees noted that it can be challenging when partners have conflicting or competing interests. Without clearly defined roles in partnerships, it can prove difficult to navigate bureaucratic processes within large organizations.

Research Question Three

What do program leaders report as important elements for a quality program?

Overview

Data from six interviews were used to address the question of elements important for a quality program. This resulted in the following five themes: relationships, scholarships, high interest and relevant content, high quality staff, and purposeful development of STEM identity. These themes are presented in rank order based on dominance of the themes.

Relationships

The ability to develop relationships was the most commonly suggested component of a quality program by interviewees. They reported intentionally working to keep group size small so that instructors and staff would build personal relationships with students. One interviewee described the importance of relationships between girls and female mentors.

> The key element is the relationships with professional mentors who have real life experience to share with the girls. They can address the kinds of micro messages that are

> sent to young girls and to help them…keep working through failure and mistakes to find a better solution. (Program Two)

Respondents often suggested mentors as a way to address attitudes and dispositions, such as modeling an interest in STEM as appropriate for females, discussing stereotype threat, and raising awareness of mathematics anxiety. Two programs described the role of near-peer mentors, mentors only a grade or two more advanced, many of whom were prior program participants. Further, they report that the high school and undergraduate mentors seem to also benefit through greater exposure to STEM content and the ability to network and build relationships with other successful, like-minded women. The director of program three reported, “We have had some undergraduate mentors who started off as campers in our program, then were mentors and really decided what career they wanted to pursue by participating.”

Numerous programs also describe the importance of building relationships with parents. The director of program five described parents’ influence on attendance, “If you don’t have parental buy-in the girls don’t show up.” This afternoon program built a closed Facebook group to share pictures and updates with parents, and it uses a texting application to engage parents and send reminders and updates. This approach was used to keep parents abreast of program news. Other programs include a separate parent component aimed at raising awareness of STEM career opportunities, college requirements, financial aid and other resources to support their daughters. Parent components were represented in a variety of forms, such as a section on a website, parent socials and evening parent classes. Despite its presence in the literature, forming relationships with same-age peers did not surface during the interviews.

High Interest and Relevant Content

Interviewees suggested that high interest and relevant content are a component of a quality program. They suggested that program leaders should support teachers and staff in developing content that is age appropriate. STEM content should also reflect student interest. For example, numerous programs purposefully choose STEM content that allows girls to make a difference in the world, such as helping the environment and other people. The director of program thee reported replacing a guest speaker with a community service activity putting together backpacks of science-related materials for students who were in orphanages.

> That [project] really resounded with them quite well because they get to select what goes into their bag and get to have an impact on the information that is being given to younger students…I think having that community service component really engaged the girls and attracts them.

Real-world application of activities and tangible products were reported as leading to higher engagement from girls. The interviewee representing program five described a high-interest STEM activity making organic body products for a spa night: "They were so focused. We researched the chemical ingredients in their store deodorants and investigated the science behind the chemicals and we looked into the ratios and percentages in the products…they were so interested." Interviewees reported asking girls for feedback regarding content in surveys and program evaluations. One representative for a program that is in its sixteenth year of operation said, "Times change and the girls change. You have to keep it fresh to keep them interested. The best way to know what they are interested in is to ask them." Additionally, directors suggested that programs use research-based pedagogy that is specific to females:

> Research talks about how boys and girls learn differently. You have to make sure that staff members have training on how to reach girls and how to make lessons collaborative. The activities need to be hands-on, engaging, and require them to think critically. (Program One)

This constructivist view of quality instruction is supported, in part, by the use of "hands-on" teaching described in 23.8% of mission statements.

High-Quality Staff

All interviewees report that a high-quality staff is necessary for a successful OST program. This coincides with question two's focus on staff selection and training. Despite the fact that all interviewees reported strategically choosing staff, the concept of what constitutes quality in staff members varies. Some emphasize the importance of staff members having deep STEM content knowledge and experience, for example:

> I've been a practicing engineer for about 30 years and…we include faculty members that are engineers and have done actual engineering research and development work or have worked in industry so that they can talk about actual applications of the content we work with is used in the real world. (Program Four)

Others emphasize the importance of appropriate professional development to develop and train high-quality staff in terms of pedagogy and curriculum:

> We do several weekend trainings before the academy starts. Gender neutral teaching strategies, curriculum, we talk about culture, we try to spell out for them what it should look like, sound like and fell like when you're walking in the classroom. (Program One)

One program director reported soliciting personnel recommendations from local school districts and science curriculum directors or tracking student test scores in courses that teachers are teaching which have the same curriculum as the OST program.

Purposeful Development of STEM Identity

Interviewees suggest purposeful attention to development of a STEM identity for participants. They discuss supporting girls in developing a self-identity as doers of mathematics and science rather than positioning STEM as “not for me.” The director of program six stated, “We help them do really well in AP physics because usually girls hit the wall in physics and say, oops, not for me, I’m out of here.” This program aims to build girls’ positive self-identity by providing opportunities for success on meaningful, challenging and relevant physics tasks in an all-girls environment.

Program directors report a perception that a STEM identity can support girls in pursuing and persisting in STEM disciplines. One such comment was, “Exposing them to different fields that they didn’t even know existed. So exposing them, so at the end of the day they can see themselves doing that job, see themselves in that STEM role.” Additionally, programs seek to dispel the myth that strong abilities in STEM disciplines are innate and genetically determined, a belief that girls use to justify an identity that is oppositional to program efforts. One respondent said:

> Micro-messages are being sent to girls that math isn’t for you, you can’t do it, it’s something that you’re not good at so you should do something else. But we tell them to keep working through things and that failure is a part of the process and mistakes are how you find a better solution. (Program Two)

A program director for an early elementary program explains her camp's decision to serve younger students in relation to identity formation by saying, "We want to foster the love of science and confidence at an early age before we have to undo the societal pressures and societal norms." Interviewees reported focusing on building STEM identities through the use of mentors and teaching growth mindset with content instruction.

Research Question Four

What do program leaders report as challenges in implementing their program?

Overview

Data from interviews was used to investigate challenges in implementing OST STEM programming for females. This resulted in four themes: funding and space; staffing; recruitment and SES; and interpersonal conflict. These themes are presented in rank order based on dominance of the themes.

Funding and Space

Funding concerns were reported by five of the six interviewees. The interviewee from program three explained the dire need for funding, "If you don't have people to help you with funding everything is pulled to a grinding halt." Some programs that are reliant on grant funding report staffing full-time positions for the purpose of grant writing. Even programs that charge fees for participation report challenges with funding. One respondent described the obstacles faced with funding and revenue:

> We have the unique revenue source that some of our girls pay full price, but the cost of a summer camp is astronomical and so we would never charge the parents what it really costs to run a program. Funding is our biggest challenge. (Program One)

Limitations in funding can also impact space availability for programming. Interviewees report challenges with the high costs of renting classroom and residential space. This is particularly problematic for programs operating on university campuses.

> I guess our biggest challenge is working with university campuses and we really think that it should be a turnkey operation implementing it on other campuses, but universities are hard to work with, they have their own funding rules and their programs get first choice at the classrooms. (Program One)

This interviewee elaborated that working with universities also came with requirements for budgets and staffing that limit autonomy of the program.

Staffing

Funding can also contribute to challenges with staffing. The coordinator for program five explained, "Funding is really difficult because we need at least three full-time people, but we can really only afford one full-time staff member to organize for 107 girls." Programs also report challenges with finding highly qualified teachers: "We have been growing and bringing more teachers in. We do have training…but finding qualified people with the right attitude is a challenge. We've only lost one teacher that started with the grant, but we are growing really fast." Programs that are reliant on volunteers also struggle with staffing. A director of a large volunteer-run program reported needing more than 90 volunteers to successfully run a summer day program for 450 girls stating, "It's a challenge to retain and organize that many volunteers to run it all." This program also reported challenges relying on volunteer fundraisers to secure funding the program. Staffing overlaps as an identified component of quality programming and as a challenge. Although programs are aware of the importance of highly qualified staff, they report struggling to find, retain and pay these staff members.

Recruitment and Socioeconomic Status

Recruitment concerns were raised by every interviewee. They report challenges in reaching the populations of girls they want to enroll. Some interviewees report difficulties working with local schools. Many programs require collaboration with schools to recruit students and find that LEA central offices do not disseminate information to school sites. Additionally, programs that communicate directly with schools report that information is not always disseminated to students or is given to ineligible students. Others report challenges serving girls who are of low socio-economic status because they require additional supports to attend OST programming. A sample comment regarding challenges reaching particular populations of girls follows:

> Our biggest challenge is getting the word out to the students, there are so many schools in [the city], it is really hard. The challenge is getting the word out to the right girls. We really want to find girls that are in pre AP chemistry…Right now the way to get the word to them is three or four people removed from the girls we want to tell. (Program Six)

This program specifically struggled with the disconnect between the central office curriculum staff and classroom teachers. Although they had connections with a science curriculum director, they found that teachers in the classroom rarely reporting knowing about the program or handing out flyers. Further, they struggled with identifying the 'right' students who were eligible for the program.

- I think our biggest challenge is increasing the diversity within our program…We don't represent the socioeconomic breakdown of our local community. We need to learn how to get the word out and better serve our local area. (Program Five)

- It's always a challenge to get the populations we want because they are the girls who do not have transportation or don't have a backup system at home to actually get them to participate. It's difficult to get the audience you want because of transportation, awareness, family support and availability. (Program Four)

Despite reporting a desire to serve girls of low SES many programs struggle to recruit and retain them. Those that report successful recruitment of low income students describe the challenges associated with making their program accessible to this population:

> We provide waivers for the fees and we arrange all of the transportation. We have even tried financially supporting public transportation and that didn't work out. We had girls at a bunch of different bus stations and no point people to make sure they brought their permission slips and lunch. (Program Three)

Socioeconomic factors, such as lack of transportation, also impact the ability to retain students in programs. A program that works specifically with low-income students in the inner city reports that just under half of the girls finish their five-year program due to transiency. The program assistant explained, "The families move a lot and it's hard to keep track of the girls. I've had to switch to contacting many of them through Facebook because their phone numbers are constantly changing." Another program that partners with Girls Inc. for transportation added:

> About 20% of the girls that come from Girls Inc. are in foster care and most of our girls are in single parent homes. There is a lot going on in their lives. Sometimes that means they can't make it to class. (Program One)

Despite the reported desire to serve students, barriers related to social class often present challenges that program staff have limited ability to address or to which solutions are not readily available.

Interpersonal Conflict

Program directors report challenges with interpersonal relationships between female participants, including bullying, theft, or inability to adjust to unfamiliar settings. Additionally, one program expressed concerns with racial divisions among social groups that results in some students reporting feeling like “outsiders.” A sample comment regarding challenges with behavior is:

> If there is a lot of stuff going on at home sometimes they bring that with them to field trips and they act out because they want attention. I think that is a challenge because you understand where they are coming from, but you know they cannot act that way in the community. (Program Five)

Summary

A mixed-method study was conducted, including website content analysis, surveys, and interviews. This chapter described results from the qualitative content analysis of 115 program websites, mixed-methods analysis of 51 survey responses, and qualitative analysis of six semi-structured interviews. The findings of this study form a mapping of K-12 OST STEM programs for girls. The programs represent 38 states. Key findings were presented in relation to the four research questions, which were:

- What are the most common features of OST STEM programs for K-12 females in terms of such aspects as curriculum, population served, program evaluation and cost to participants?
- What are typical program goals, staffing decisions and program designs for K-12 OST STEM programs for females conducted in the United States?
- What do program leaders report as important elements for a quality program?

- What do program leaders report as challenges in implementing their program?
- Race and ethnicity demographics are not tracked by all programs. However, within programs that track these demographics, White students are the most likely to be served by female OST STEM programs. The data indicate that programs exist in all grades from kindergarten to twelve; however, most programs serve middle-grades girls. The majority of programs have no selection criteria beyond meeting the age or grade requirements. All STEM disciplines are addressed in camp content, however, mathematics is frequently used to support the other disciplines, rather than serving as its own discipline. Fees vary widely across programs, and the majority of programs offer some financial assistance for students in need.

The majority of female STEM OST programs have mission statements that address inspiration, college and career preparation, exposure to STEM disciplines, dispositions, role models, skills and knowledge, leadership, the gender gap and diversity. Regarding staffing, all-female staffing is most common and attributed to the need for female role models. Additionally, programs are most likely to hire college students, university STEM faculty, K-12 teachers, STEM industry professionals, and social science university faculty. Programs rely on part-time staff and volunteers. A majority of programs are day programs. Residential programs are less common and are most likely to take place during the summer. Most programs include 10-49 contact hours per year. Regarding partnerships, programs are most likely to be affiliated with STEM industry companies or higher education institutions.

Program leaders report the following key elements for a quality program: relationships, high interest and relevant content, high quality staff, and purposeful development of mathematics identity. Program leaders report the following challenges in implementing their programs: funding, space, staffing, recruitment, socioeconomic status, and interpersonal conflict.

The next chapter includes discussion of the results situated within current literature. Additionally, conclusions and directions for future research are presented.

Chapter Five

Chapter Four reported the study results, K-12 female OST STEM program curricula, content, application and selection process, population, program evaluation and costs. Additionally, findings included typical program mission and goals, staffing decisions, scheduling and partnerships across programs. Finally, the perceptions of program leaders regarding key characteristics of high-quality programs and challenges to their implementation were discussed. Chapter Five presents discussion on the research findings as situated within current literature. This chapter also presents conclusions and directions for future research.

Discussion

Research Question One

What are the most common features of OST STEM programs for K-12 females in terms of such aspects as curriculum, population served, program evaluation and cost to participants?

Race, Ethnicity, SES and Language

Approximately two-thirds of OST programs in this study collect data on race or ethnicity Many OST programs in this study do not collect data on language or SES. This is of concern given that OST programs differentially affect students based on these demographics. Students of varying SES tend to live in different neighborhoods, attend different schools and have different access to OST programming (Hynes & Sanders, 2011). For example, low-income students and students of color are more likely to attend programs that include academic components such as tutoring or homework assistance (Durlak et al., 2009). Additionally, specific program features might be more beneficial for subpopulations (Hirsch et al., 2010). Without demographic data outcomes and program evaluation data cannot be disaggregated to investigate best practices for subpopulations. This is of concern given that literature suggests a need for specific evaluations, program features and intended outcomes for numerous populations, including Latino urban adolescents (Bruyere & Salazar, 2010; Riggs, Bohnert, Guzman, & Vandell, 2010), English language learners (Maxwell-Jolly, 2011), African-American adolescents (Bhattacharyya & Mead, 2011), females (Froschi, Sprung, Archer, & Fancsali, 2003; Wiest, 2008) and specific grade-level ranges (Pierce et al., 2010).

In this study some programs for females report tracking race and ethnicity demographics of participants. The most common method is asking students or parents to self-report on application or registration forms other programs use data from local school districts or guess based on surnames and conversations with students. Despite the lack of formal collection of race and ethnicity data, some programs report using the information they do collect to increase diversity in their participants.

> In selecting the final 32 participants, the PD seeks diversity in age, school size, residence location in Colorado, and race/ethnicity based on surname. Although diversity is important, the applicant's letter of intent is instrumental in the final decision. Specifically, the PD strives to select applicants who want to be the first in their family to attend college, who speak passionately about mathematics, or who have minimal opportunities for such an experience due to geographic isolation. (Soto-Johnson, 2017, p. 7)

Some programs place a particular emphasis on underserved girls, including students who are racial and ethnic minorities, English Language Learners or rural students.

Research in co-educational OST programs have found mixed results in program evaluation efforts that disaggregate data by race, ethnicity or language (e.g. Kim, 2006; Kim & Guryan, 2010; McCombs et al., 2014). These mixed findings and limited data sets call attention to the need to collect demographic information and disaggregate findings by race/ethnicity, which might lead to strategies for reaching and advancing out-of-school-time opportunities for underrepresented populations. This is particularly relevant in all female programs, as investigating multiple intersections of youth's identities (e.g. race, ethnicity, sexuality, gender) can provide a variety of voices and experiences in determining best practices.

Age and Grades

This study of out-of-school-time STEM programs for females found that programs serve girls in grade kindergarten to twelve and are most likely to serve adolescent girls in the middle grades. However, McCombs et al. (2014) assert that findings regarding the effectiveness of co-educational summer programming at different age groups are mixed, with some programs showing more positive effects for early primary grades, others showing more positive effects for students in higher grades, and some failing to identify significant differences between grades. This meta-analysis, however, was not specific to girls or STEM disciplines.

The focus on middle grades girls in STEM OST programs aligns with recommendations from the literature given that girls tend to have equal performance in STEM disciplines in elementary school but begin to doubt their abilities in middle school (Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development, 2000). Concerns about girls' interests and participation in STEM can be attributed, in part, to low self-esteem, which contributes to poor academic performance and lower ambitions (Jobe, 2003; Soto-Johnson, 2017). This might be especially critical for girls from racial/ethnic minority groups (Hodge, Matthews, & Squires, 2017). Middle school is a critical time for decision making, with experiences prior to age 14 as the primary influence in the pursuit of STEM study

(Archer, DeWitt, Osborne, Dillon, Willis, & Wong, 2010) and middle school interest in STEM correlating significantly with future STEM careers (Dabney et al., 2011).

Some call for increased attention to girls in the early elementary grades (e.g., Archer et al., 2010) based on the findings that preschool mathematics knowledge predicts mathematics achievement into high school (Ablamsky, 2017). Further, research suggests that girls express gendered beliefs about intelligence as young as six years old (Yong, 2017) and that these beliefs might be reinforced by kindergarten teachers (Gholipour, 2016). Maltese and Tai (2010) assert the importance of planning in elementary school to attract students into STEM fields, given that approximately one-fourth of science, engineering and technology professionals report considering a STEM career before the age of 11 (Office for Public Management for the Royal Society, 2006). Similarly, Robinson-Cimpian, Lubienski, Ganley, and Copur-Gencturk (2014) found that gaps in STEM academic achievement exist in early elementary school, signaling a need for earlier intervention. The present study found that few programs are available to early elementary girls in STEM, with only ten percent of programs admitting kindergarteners. Given the research on early elementary interest in STEM fields, this might suggest a need to expand programming to younger students.

Application and Acceptance Criteria

Out-of-school-time STEM programs for females are most likely to admit students without additional criteria. Admitting students without restrictions is supported by the literature. For example, Erchick (2017) describes how the Mathersize Summer Mathematics Camp has no requirements for camper skill or performance levels prior to camp and admits girls on a first-come, first-served bases. However, she contends that the self-selective natures of a first-come, first-served program parallels the “community nomination strategy” (Ladson-Billings, 1994), which allows the students, teachers and parents to judge the value and appropriateness of a program (Erchick, 2017). Alternatively, some programs require a competitive application process. For example, Houck et al. (2017) describe a rigorous application process for the GOALS for Girls Program, which includes an essay, school transcripts, short-answer questions, a teacher recommendation, and one-on-one interviews.

From an equity perspective, the widely used first-come, first-served practice of OST programs raises concern. Students might not have access to the same resources to apply based on SES, access to technology, language or other factors. Kekelis (2017) asserts, “Girls from communities in need face the greatest disadvantages and fewest chances to develop positive attitudes about STEM, as their communities lack resources and access to opportunities” (p. 57). First-come, first-served applications might further limit access to opportunities for these students. Additionally, research indicates that girls are less likely to participate in voluntary programs without targeted outreach (e.g., Henriksen, Jensen, & Sjaastad, 2015). This study found that OST STEM programs for females struggle to achieve targeted outreach for students of low SES. These challenges coupled with the common first-come, first-served application limit opportunities to purposefully recruit girls who might otherwise not participate, seemingly more for some underrepresented groups, such as girls from low-income families. This might suggest a need for alternative application and acceptance criteria for many programs. Programs might consider holding a proportion of student seats for low-income students who are specifically recruited through partnerships with low-income schools. Additionally, programs might consider a lottery system to select participants instead of a first-come, first-served acceptance. Finally, applications should be made available in hard copy for access by students without internet.

Content and Curriculum

Field of Study

The STEM programs in this study were unlikely to focus on mathematics as an area of study. Instead, they reported the role of mathematics as applied to science, technology and/or engineering. This is supported by Becker and Park (2011), who found that few integrative approaches in STEM included mathematics. Perceptions of mathematics influence its role in STEM programming. K-12 OST STEM programs for females report that students hold problematic perceptions of mathematics, saying, "Still, the girls saw mathematics as skills-based content, mostly focused on doing mathematics in the traditional sense by using algorithms to solve problems and performing the operations of addition, subtraction, multiplication, and division" (Erchick, 2017, p. 43). Similar perceptions of mathematics are held in higher education with the role of mathematics in STEM is often seen as a tool to solve problems in science, technology and engineering (Enderson & Ritz; 2016). Additionally, in higher education mathematics is seen as a tool whose usefulness varies by discipline, with students in STEM fields being required to complete more mathematics coursework. The positioning of mathematics as a tool is concerning given that "it teaches a person how to approach tasks methodically, pay attention to details, and to think abstractly" (Enderson & Ritz, 2016). Additionally, mathematical literacy is key to informed citizenship and life quality through areas such as health, education, and finance (Wiest, Higgins, & Frost, 2007). Students who lack mathematical literacy are ill prepared to participate in society and to make effective everyday decisions.

Content Alignment

Relatively few commercially developed OST curriculums are available (Augustine, 2013) and despite the many freely available curricula, these free curricula are not vetted nor necessarily used as intended (Means et al., 2011). As a solution to these challenges, Houck et al. (2017), describe a process of curriculum development that includes a ten-member committee of women who are STEM researchers and practitioners. Some programs have attempted to address this by providing curriculum to partner OST providers. For example, Techbridge provides training and curriculum to its partners, including local school districts, YMCA, and Boys & Girls Clubs (Kekelis, 2017). The findings in this study mirror some programs using commercially available OST curriculums, such as the program available through SciGirls. Similar to Houck et al. (2017), some programs reported a standardized process of developing curriculum with a team. In contrast to the literature, many programs in this study report a less standardized approach that relies on networking and individuals writing based on their knowledge of the research base on STEM and females.

Camps report supplementing, accelerating or remediating school learning. Selection of content is driven, in part, by an intent to provide access to topics that lack sufficient attention in school (e.g., Wiest & Crawford-Ferre, 2017), expand learning for advanced students (e.g., Bevan & Michalchik, 2013), remediate gate-keeper content (e.g., Augustine et al., 2013; McCombs et al., 2014; Wimer & Guner, 2006), or explore content in which girls tend to demonstrate weak performance and/or dispositions (e.g., Wiest & Crawford-Ferre, 2017). Durlak, Weissber, and Pachan (2010) assert the importance of well-rounded content, calling for increased attention to personal and social skills to enhance self-efficacy and self-esteem. Others articulate the importance of creativity as a critical part of STEM careers (Soto-Johnson, 2017), public speaking and networking (Kekelis, 2017), 21st-Century skills (Houck et al., 2017) and personal health (Girls Incorporated, 2014; Gonsalves, Rahm, & Carvalho, 2013).

In this study OST STEM programs for females were most likely to report aligning content to themes in mission statements rather than to specific standards or benchmarks. Wiest and Crawford-Ferre (2017) defend this position, saying:

> While increased knowledge and skills are also quite important, they are necessarily limited to the small subset of mathematics content that can be addressed in a finite amount of time, whereas confidence can linger and grow well beyond the program in an unbounded sense. This seems to be the root of what inspired many girls years after leaving the program, as discerned by many anecdotal comments shared by alumni or their parents. (p. 23)

In contrast, however, some argue that to show growth on school standardized assessments, summer curriculum must align to school year curriculum and goals (Augustine & McCombs, 2015), with students expecting to apply what they learned in one lesson to subsequent lessons (Augustine et al., 2013). This position, however, is argued in literature regarding co-educational OST programming provided by school districts, perhaps identifying the divergence in goals between OST STEM programs for females and OST programming provided by school districts.

The lack of content standards and commonality among STEM OST programs for females is potentially of concern when considering features of effective programs. With wide variety in goals, curriculum and programming it is challenging to compare programmatic outcomes. Additionally, the non-standardized curriculum development might lead to varying levels of quality given the education and skills of the developer(s).

Pedagogy

In this study, OST STEM programs for females were likely to report active, collaborative or hands-on learning as key pedagogical strategies. Hands-on STEM learning was commonly reported on websites, in survey responses and in interviews. This best practice is mirrored in the literature. For example, Soto-Johnson et al. (2011) recommend that teachers "create learning environments where students can collaborate with one another and learn mathematics conceptually" (p. 138). Hands-on learning is often cited as one of many gender-specific STEM teaching strategies for girls. Gender-specific pedagogy for females is a frequently cited benefit of all-female programming (Crawford-Ferre & Wiest, 2013). Kekelis (2017) reports the implementation of gender-specific pedagogical recommendations of Eccles (1989), noting that hands-on, cooperative formats encourage all students to participate. Similarly, Wilmer and Gunther (2006) report that hands-on learning increased girls' interest in science and science-related careers. This pedagogical practice can benefit females, in addition to minority students and low-achieving males (Kekelis, 2017). Feedback from girls also reinforces the importance of hands-on instructional approaches, with girls listing active learning and hands-on learning as top instructional techniques in evaluations of a mathematics and technology camp (Wiest & Crawford-Ferre, 2017). Despite this consensus, there is little detail about how hands-on learning is conceptualized by each of these programs and thus, despite using the same language, there might be great variety in implementation.

Student Driven

Many OST STEM programs for females report allowing student interest and feedback to drive content and curriculum decisions. The current study provides additional evidence of this practice, with interviewees discussing designing and altering content based on student feedback and preferences. Student-led decision making is cited as a strategy to increase interest and attendance (Augustine et al., 2013). Kekelis (2017) conducted focus groups with girls in the local community to determine their interests in STEM. Focus groups, which mirrored the demographics of local schools, found that girls wanted hands-on experiences that were different than school science. Similarly, the long-running program Techbridge has redesigned its curriculum over 16 years, relying on student interests as a guide. Kekelis (2017) describes how student interests are tracked through observations, surveys and focus groups. Curriculum is then piloted, reviewed by educators and revised over multiple cycles. Contributors to curriculum include scientists, engineers, teachers and external experts (Kekelis, 2017). This inclusion of experts is important when considering student interest in curriculum planning, as girls might be less likely to express interest in STEM content due to a lack of prior experiences and sociological factors. For example, girls might fail to suggest potentially rich topics, such as robotics, without prior experience in the field (e.g., Witherspoon, Schunn, Higashi, & Baehr, 2016). Data in this study suggest a lack of resources for curriculum development, as well as limited staffing, time and funding. These limitations lead to a lack of a standardized curriculum, with classroom instructors often building their own lessons with little direction or oversight.

Program Evaluation

Historically, OST programming show a dearth of evaluation data, with limited information used to satisfy the requirements of funding sources and to generated reports that often went unread (Wilkerson & Haden, 2014). With the growth in OST programs, the National Summer Learning Association Quality Standards were developed (McCombs et al., 2011) and the Harvard Family Research Project compiled program-evaluation resources and instruments used to assess academic and educational attitudes and values. Additionally, long-term effects on standardized test scores for low-income students attending summer remediation programs were tracked (Augustine et al., 2016), and authors reported a strategic shift towards formative program evaluation for program improvement (Wilkerson & Haden, 2014).

The data from the current study indicates OST STEM programs for females are likely to collect some program evaluation data. Data collected are most likely to be participant-generated data, including pre/post and survey assessments. This aligns with literature reporting the use of a combination of surveys, observations, focus groups and interviews to provide program developers with feedback for continuous improvement (Wilkerson & Haden, 2014). OST STEM programs for females are less likely to collect academic or skill data. In part, this might reflect the research that many STEM OST providers “do not see it is as their direct goal to improve test score results, but instead they strive to increase involvement and exploration with STEM, decrease anxiety around STEM and energize motivation” (Krishnamurthi et al., 2014, p. 7). Programs that do collect academic information report the avoidance of standardized assessments, due to concerns about misuse of assessments, narrowing of curriculum, and misalignment to program goals. Further, Houck et al. (2017) elaborated that pre-post skills data were collected from student worksheets rather than content assessments due to the negative response to perceived high-stakes testing from students and staff. Additionally, programs in this study report specifically choosing content that receives limited attention in schools, often due to the lack of emphasis in those areas on K-12 standardized assessments.

In an effort to align program evaluation with program goals, elements and outcomes, programs are more likely to evaluate affective changes, such as confidence (e.g., Wiest & Crawford-Ferre, 2017) or interest in careers (e.g., Hodge, Matthews, & Squires, 2017). Krishnamurthi et al. (2014) assert that research supports affective measures as tools for evaluation. This is due to the known associations between OST STEM activities and post-secondary majors and careers (e.g., Dabney et al., 2012).

Roth and Brooks-Dunn (2016) assert that formalizing program evaluation for youth development programs is the next horizon of OST research, particularly given the concern that policymakers will fail to fund OST programs whose effects do not register on standardized school assessments. Given the connection between evaluation and funding and the avoidance of standardized assessment use by programs, it is key for OST STEM programs to clearly communicate the known connections between affective measures, such as math anxiety, and educational outcomes.

Program Evaluation Outcomes

Despite a movement towards evaluation of intervention programs aimed at increasing the number of women in STEM, programs have shown mixed results (Hodge, Matthews, & Squire, 2017). Few OST STEM programs have documented long-term impacts on participants' life trajectories (Thiry, et al., 2015). Soto-Johnson (2017) asserts that the studies needed to evaluate long-term outcomes are often impossible due to constraints of time and money. Other programs have not existed long enough to track students beyond high school. The Eureka program, for example, intends to start tracking longitudinal data in the next two years, including high school graduation rates, university attendance, college major and college degree persistence (Hodge, Matthews, & Squires, 2017). This is a newer program whose first cohort of students will graduate high school in the next year. Further, investigations of future STEM degree and career pursuits have "many confounding variables, such as home life, participation in extracurricular activities, socioeconomic status, parents' educational background, and so forth" (p. 21).

Despite the many program-evaluation challenges for STEM OST programs for females, the process is also ripe with possibilities. For example, Kekelis (2017) suggests that girls be involved in both program design and evaluation. This collaboration potentially provides girls with an opportunity to think critically and reason with data collection and analysis. Additionally, she asserts that student collaboration in survey design can lead to interesting information about student perceptions that might otherwise not be assessed in program evaluation.

Research Question Two

What are typical program goals, staffing decisions and program designs for K-12 OST STEM programs for females conducted in the United States?

Mission and Goals

Mission and goals for out-of-school-time STEM programs for females include: inspiration, college and career preparation, exposure to STEM disciplines, dispositions, skills and knowledge, leadership, gender gap and diversity. These mirror existing research, which indicates that OST STEM programs are typically designed to allow participants to explore STEM content and careers and inspire interest in STEM (Houck et al., 2017; Mohr-Schroeder et al., 2014; Wiest et al., 2017; Wilkerson & Haden, 2014). Soto-Johnson (2017) described the Las Chicas de Mathematicas camp goals similarly: The camp “impacts young women’s confidence in their ability to do mathematics, informs them about STEM-related careers, and piques their interest in learning advanced mathematics” (p. 1). Confidence is selected as a focus because it can grow beyond the program, in contrast to skills, whose development is more limited (finite) in a one-week camp (Wiest & Crawford-Ferre, 2017). A primary focus on inspiration, college and career preparation, and exposure to STEM disciplines and dispositions aligns with Kekelis’ (2017) assertion that although “girls have the ability to pursue careers in these fields, they might not have the interest, confidence, motivation, or awareness of how these fields can be rewarding” (p. 57).

Staffing

Single-Sex Education

According to these research results, out-of-school-time STEM programs for females are most likely to employ an all-female staff. Program directors reported a desire to build community and provide role models. This is supported by existing literature. For example, the founder of Techbridge (Kekelis, 2017) suggests:

> Make space and programs just for girls. The girls-only element helps build confidence and is especially important in subjects such as technology and engineering, in which girls might have less exposure than boys. Without fear of being teased for not knowing how to use a power tool or how to debug a computer program, girls are more inclined to try new skills and persevere through failures. It is important to be explicit with girls and families regarding why the program is dedicated to girls. Statistics can help make the case for the need for more females in STEM. With girls, the discussion can be a learning opportunity to explore stereotype threat and growth mindset. (Kekelis, 2017, p. 74)

Additional researchers have found that girls-only environments allow for girls to challenge stereotypes and try new things (Hines & Augustyn, 2017; Kekelis, 2017). Erchick (2017) illustrates the desire of some girls to attend a single-sex camp with camper comments "I would love to go to the Mathersize camp to meet new friends and there will be no boys" and "I wanted to attend an all-girls camp because boys play to [*sic*] much in class and it is hard to concentrate" (p. 45).

Staffing Decisions

Out-of-school-time STEM programs for females are most likely to be staffed by a combination of employees, including: college students, STEM university faculty, K-12 teachers, STEM industry professionals and social science university faculty. This combination of staff types is supported by the literature. For example, Hodge, Matthews, and Squires (2017) describe a staff that includes higher education faculty members from a variety of disciplines, elementary school teachers and volunteers. Similarly, Mosatche, Matloff-Nieves, Kekelis, and Laener (2013) describe a program that purposefully hired social workers who had academic STEM background to facilitate integration of STEM concepts into leadership curriculum for girls.

A diverse combination of staff members is not without challenges. Hodge, Matthews, and Squires (2017) describe the challenges of coordinating and collaborating with a diverse staff and suggest that programs hire a dedicated coordinator to serve as "the liaison between the university and the partnering organization, as well as the person responsible for scheduling sessions, training student workers, organizing and presiding over planning meetings and handling daily camp logistics" (p. 94). Similarly, Augustine, McCombs, Schwartz, and Zakaras (2013) suggest that roles be clearly delineated to minimize confusion about who is responsible for selecting curriculum, recruiting students, training teachers and providing transportation. In this study multiple respondents who worked with universities echoed the findings of Hines and Augustyn (2017), who noted that camps on university campuses need support staff to navigate bureaucracy and ensure compliance with university policies.

Out-of-school-time STEM programs for females are most likely to be comprised of part-time staffing, with less than half of staff members having a background in education or youth development. This is contrary to research-based recommendations to invest in highly qualified staff (McComb et al., 2012) and purposefully include K-12 teachers who have preexisting relationships with youth participants (Wimer & Gunther, 2006). Less than half of the programs in this study are staffed by individuals with a background in education. This is concerning given

Augustine et al.'s recommendation that teachers should be purposefully selected to maximize the match between teacher grade level and content experience to increase teachers' familiarity with the school-year curriculum and standards. A combination of STEM professionals and professional educators might collaborate to create a program that is strong both in content and pedagogy.

Scheduling

Out-of-school-time STEM programs for females are most likely to be day programs that meet during the summer. This study found that OST STEM programs for females are more likely to be day-only programs than residential programs, with only 14 survey respondents and one interviewee offering residential programming. Summer programs are most likely to be a one-week summer camp that meets for 10 to 49 contact hours. This is supported by literature with positive effects on student achievement documented in summer programs regardless of whether they are mandatory or optional (McCombs et al., 2011), or run by school districts or independent of districts (Augustine et al., 2013). Houck et al. (2017) described the decision of the GOALS for Girls camp to shift programming from the school year to summer months to make programming more accessible for all youth. Further, summer programming might also allow for fewer time conflicts, as participants occasionally miss part of OST programming because of being involved in other activities at the same time (White, 2013). Respondents in the current study also described accommodating girls' schedules as a consideration when determining scheduling by allowing girls to arrive early or stay late each day. Additionally, flexibility in scheduling might allow for a wider audience of participants as partial day programs privilege girls with access to transportation during typical working hours.

Recreation

The current study found that residential out-of-school-time STEM programs for females are more likely than day programs to schedule separate recreation programming. Day programs are more likely to report embedding enrichment, physical activity or active learning into their academic content instruction. Augustine et al. (2013) support inclusion of recreational activities, finding that voluntary co-ed programs with the highest attendance included heavy enrichment activities that were substantially different from school. Additionally, Augustine and McCombs (2015) found that the school district with the greatest number of enrichment activities available to students also had the least behavior incidents with students, suggesting a possible correlation. Soto-Johnson (2017) reports that in an all-girls STEM camp, recreational activities, such as rock climbing, allow girls to break free of their shyness and serves as an opportunity for bonding. Similarly, All Girls/All Math designs lunchtime recreational activities to build camaraderie among girls, such as going to an ice cream shop and playing volleyball (Hines & Augustyn, 2017). Beyond increasing attendance, findings from this study show that relationship building between teachers, staff and students and the opportunity gap in recreational options as reasons for including recreation. For example, programs purposefully plan recreation to increase bonding and relationships between girls to help them potentially build support networks of same-aged females in STEM. Other programs report offering recreation opportunities that are typically unavailable you low SES youth such as rock climbing, hiking, swimming and biking.

Recreation, however, must be strategic. Augustine and McCombs (2015) caution that not all recreational and co-curricular activities need to be connected with academic content and when connected, they must highlight the academic content. For example, adding an interpretive dance activity about weather might mask the science content in meteorology. Augustine et al. (2016)

further caution that student response to non-core academic activities varies by site and that programs do not need to disguise academics to increase attendance. This is supported by Wiest & Crawford-Ferre (2017), who report that girls listed academics as more important than recreation in a program evaluation of an all-girls math and technology camp. A limitation to this study is the minimal information provided on recreation planning and outcomes. No programs in this study reported evaluating the outcomes of recreation.

Partnering

Out-of-school-time STEM programs for females are most likely to partner with higher education institutions and industry. The Techbridge camp director describes partnerships thus:

> Partnerships are key to our success. Techbridge partners with role models at organizations and universities, including Chevron, Google, Samsung, Cisco…. We strive to recruit role models who are from the community and represent our girls…. We are explicit in our partnership requests, seeking partnerships with professional organizations such as the Society of Hispanic Professional Engineers and the National Society of Black Engineers. (Kekelis, 2017, p. 65)

Partnerships with industry and universities can offer girls opportunities for scholarships, awards, and academic support (Hodge, Matthews, & Squire, 2017; Kekelis, 2017). Similarly, this study found that 50 of the programs represented in survey responses offer opportunities for scholarships based on financial need.

Out-of-school-time STEM programs for females additionally partner with schools and teachers. This is supported by Wimer and Gunther's (2006) research on co-educational summer programs in which results show that programs need the assistance of schools to identify and recruit both youth and staff for programs. They further suggest that partnerships should be fostered early to "allow enough time to build relationships…engage in program planning…[and] develop formal mechanisms that will allow schools to transfer academic and social information regarding students' academic and personal needs" (p. 7). Additionally, school partnerships can offer in-kind contributions such as facilities and meals (McCombs et al., 2012). Despite the potential benefits of partnerships with schools, only three survey respondents in this study reported this kind of partnership. Instead, respondents reported building relationships with individual teachers to assist with recruitment and with central office and leadership staff to assist with identifying high-quality staff members. Further, respondents reported challenges in navigating the relationships between central office leadership and individual school sites. Partnerships with schools could prove as an area of improvement for OST programs. Additionally, by including partnerships with low-income schools programs might find assistance with their expressed concerns regarding diversity and recruitment.

Research Question Three

What do program leaders report as important elements for a quality program?

Role Models

Out-of-school-time STEM programs for females suggest providing role models as an important element for a high-quality program. Role models can be instrumental in helping young girls envision themselves as successful STEM professionals (Seymour, 2006). Weinberg et al. (2007) investigated the outcome of a robotics program for girls, finding a correlation between good mentor/mentee relationships and improved self-concept and expectations for success in science and mathematics. Similarly, Stoeger, Duan, Schirner, Greindl, and Ziegler (2013) found that a one-year online mentoring program for girls in STEM resulted in statistically significant improvement in self-confidence and academic elective intentions.

Role models might interact with girls in a variety of capacities including serving as mentors, assisting girls with opportunities to participate in STEM activities, or providing encouragement for girls to participate in STEM-related coursework or extracurricular activities. Soto-Johnson (2017) describes the role of daily guest speakers in her OST program as follows: “Besides offering a description of their day-to-day job, the daily speakers share their stories about preparing for college, choosing a college major, changing careers, balancing career and family and anything else they believe might be valuable” (p. 10). It is key that female role models in STEM share that they have interesting lives outside of their work environment to help dispel girls’ negative stereotypes about STEM professionals (Mosatche, Matloff-Nieves, Kekelis & Lawner, 2013). This assertion aligns with the present research findings, in which participants emphasized hiring all-female staff to serve as role models and reaching out to STEM fields for additional mentors. Program directors further suggest that in addition to selectively recruiting females in STEM disciplines, role models should be specifically chosen to represent the diversity of campers so students might see themselves in STEM careers, given that “for low-income and underrepresented girls, the chances of knowing a woman working in STEM with whom they can identify are small” (Kekelis, 2017). Further, these relationships offer access to social capital to support their academic and vocational STEM pursuits. For example, in the GOALS for Girls science program, girls practice dressing for interviews and networking with visiting professionals (Houck et al., 2017).

Planning to include role models is not without challenges. The current demographics in the STEM workforce can make it difficult to recruit role models from the same ethnic and socioeconomic groups as students in OST programs (Mosatch et al., 2013). Additionally, Kekelis and Joyce (2014) caution that scientists and engineers do not learn in their career how to talk about their fields of study in ways that are engaging to students. To address this concern the Techbridge OST program developed role model guides, online resources and trainings to support role models.

Relationships

With Instructors and Other Staff

Lopez (2015) asserts that emotional engagement with caring adults allows adolescents to negotiate their own identities, experiment with self-expression and take part in challenging experiences. These relationships go beyond the often limited time girls spend with STEM role models. Out-of-school-time STEM programs for females report low adult-to-student ratios as an important element for a high-quality program. A low ratio of staff to students allows for staff to dedicate a reasonably substantial amount of time to each girl and to address girls' individual, social and academic needs (Erchick, 2017; Soto-Johnson, 2017). Students who develop strong relationships with staff are more likely to report feeling connected to an OST program and are more likely to attend regularly (Lopez, 2015). The goal of building relationships among teachers, staff and students is supported by this study, with programs reporting an effort to keep group sizes of students low and some programs offering recreational programs in an effort to build well-rounded relationships with students.

With Like-Minded Females

Lopez (2015) asserts that peer relationships are important to encourage youth to try new activities and build skills. These relationships with like-minded females can provide a safety net to negotiate negative micro-messages and explore new content. Out-of-school-time STEM programs for females report a sustained benefit for participants who build networks of like-minded females that continue into post-secondary education. Erchick (2017) asserts that programs must purposefully plan to build collaborative working groups to facilitate relationships among girls. Some programs extend this purposeful facilitation beyond the OST summer programming by providing and monitoring secure social media platforms that allow girls to socialize and support each other online (Wiest, Vega, & Crawford-Ferre, 2013). In contrast, respondents in this study only mentioned near-peer relationships, such as those between high school participants and undergraduate college mentors and there was no mention of facilitating continued interaction between peer participants after the duration of the OST program. Given that sustained peer relationships with like-minded females might assist in mitigating negative micro-messages, facilitating sustained relationships between peers might better allow girls to maintain positive affective dispositions in the future.

With Families

Out-of-school-time STEM programs for females report that relationships with families are also essential for sustained success (McCombs et al., 2012). Programs benefit from the inclusion and feedback of families. It is key that programs make it clear that families are valued and important. Kekelis (2017) provides the example that translating all materials and presentations into other dominant languages of participants' families is important to convey this message. Relationships with parents can help programs better understand how to support the girls they serve (Wimer & Gunther, 2006). Further, these relationships are "critical to ensuring youth sign up for and attend programs, relationships with families can help program recruit and retain youth" (Wimer & Gunther, 2006, p. 7). Encouragement from families can foster and reinforce interest and provide girls an extended network of support (Augustine et al., 2016; Google, 2014; Houck et al., 2017). This was supported by interviewees in this study who discussed the importance of communicating with families for both recruitment and retention of participants. Additionally, parent buy-in was reported as necessary for programs using reform-based instructional practices to garner support for instruction that "looked different" than the instruction experienced by parents.

Programs can also provide key support to families. For example, Kekelis (2017) asserts that "parents often do not realize that their daughters might like to tinker, work with tools, or take on a household repair project, and girls themselves may not ask to engage in these projects" (p. 64). Many parents feel underprepared to support their daughters in STEM and thus appreciate relationships and support from OST programs (Kekelis, 2017). Wimer and Gunther (2006) suggest creating opportunities for parents to get involved, such as parent orientations, open houses, and end-of-program celebrations. Parent feedback from OST evaluations supports the desire to be included. For example, parents from one program requested that field trips be filmed and shared and that they be invited to participate throughout the program (Kekelis, 2017). To meet this need some programs provide parent seminars and resources (e.g., Northern Nevada Girls Math Camp, n.d.; Pena, Kekelis, Anaya, & Joyce, 2013).

Girls Making a Difference

In discussions about high interest and relevant content, representatives of OST STEM programs for females report applicable content that allows girls to make a difference as an important element for a high-quality program, claiming that girls say they want to make the world a better place but do not understand how STEM careers align with this goal (Kekelis, 2017). This is well supported by literature calling for attention to the societal relevance of engineering to highlight the relationship between "engineering products and services and how they can improve individual lives and benefit society and the environment" (Baker, Krause, Yasar, Roberts, & Robinson-Kurpius, 2007, p. 213).

Selected ways to address this best practice involve including real-world applications (Kekelis, 2017), engaging in humanitarian engineering (Soto-Johnson, 2017), including service learning (Kekelis, Ancheta, Heber, & Countryman, 2005), and identifying elements in personal life stories that relate to science (Gonsalves, Rahm, & Carvalho, 2013). Application-oriented STEM work can lead to greater engagement and increase the likelihood of girls seeing STEM as a viable career choice. Existing literature offers examples of relevant real-world applications. For example, Hines and Augustyn (2017) report that girls who learned public key cryptography in an all-girl OST STEM program were very excited to use a practical application for mathematics. Similarly, girls in Houck et al.'s (2017) OST STEM program discussed their newfound ability to make a change in the lives of others during reflective writing, saying, for example, "I can actually make a difference and give back to my community" (p. 146).

This study reported here also identified instruction with real-world components and societal relevance as key program features. Respondents, for example, provided such examples as citizen science and sustainability as areas that foster connections between STEM and benefits to society and the environment. This can serve as a key feature of OST STEM programming for females that programs can implement when planning curriculum and content.

High-Quality Staff

High-quality staff members were identified as an important element of effective programs. This is supported by literature, with "teacher quality having the largest school-based impact on student outcomes" (Augustine & McCombs, 2015, p. 13). Augustine and McCombs (2015) describe how some programs implemented a rigorous screening system for teachers that included an essay, interviews, recommendations and classroom observations before selecting teachers for a summer OST program. Similarly, Wiest and Crawford-Ferre (2017) report purposefully selecting staff who are considered highly effective at maintaining student-centered mathematics instruction for an all-girls math and technology program. Hiring high-quality staff can be challenging, however, given that more experienced and skilled teachers often prioritize their school breaks and are less likely to teach in OST programs (Wimer & Gunter, 2006).

In addition to hiring strong staff, training is suggested to increase staff quality. Programs report shifting toward including staff training as a form of program improvement. For example, Erchick (2017) described a change in their camp's training saying, "In subsequent camps we included in our teacher training how to help the campers develop skills to work together" (p. 48). Further, paying staff to participate in training sends the message that this work is valued by the program. For example, Kekelis (2017) explains that teachers are paid a stipend for professional development when starting with the OST STEM program she conducts and that ongoing training is optional, but paid, to allow teachers to network across programs and schools. Specific to female OST STEM programs, training might extend beyond content. For example, Hodge, Matthews, and Squire (2017) describe how an OST program for at-risk middle school girls provides culturally responsive training to volunteers to prepare them to work with diverse girls. Similarly, Kekelis, Ancheta, Heber, and Countryman (2005) describe the addition of diversity training for teachers to "heighten participants' awareness of inequities caused by race, gender and class…[with an] attempt to address their concerns" (p. 240). Programs in this study additionally report training on stereotype threat and gender issues in STEM to its staff.

Providing staff training is not without challenges. The current study found that some programs lack funding, time and personnel to provide training for teachers. Additionally, Augustine and McCombs (2015) report that teachers are often distracted by logistical questions, such as class sizes and room locations, when training is scheduled right before the start of a program. Despite these challenges, those developing and revising programs are encouraged to consider providing opportunities to provide professional development options to network, co-plan, and develop skills. This collaboration time might also increase continuity in instruction across a program.

Research Question Four

What do program leaders report as challenges in implementing their program?

Recruitment

Challenges with recruitment are reported for OST STEM programs for females. This study identified numerous challenges to recruitment, including reaching eligible potential participants, communication challenges with LEAs, and barriers to recruiting diverse participants due to low SES. These challenges are supported by the literature. For example, Wiest and Crawford-Ferre (2017) describe challenges of guaranteeing that flyers given to schools are passed out to students. Additionally, despite a cover sheet that includes directions to distribute the flyer to all girls, teachers frequently only distribute the forms to higher-ability girls. Communication with families can also be challenging. It is necessary to notify parents about programs early before they make alternate summer plans (McCombs et al., 2012). Recruitment is particularly problematic for families who are unable to read forms that are only available in English. Other programs report attempts to mitigate these problems, including translating all materials to other languages, making applications available in both paper and digital formats, and contacting and supporting students who only partially complete electronic applications (Houck et al., 2017; Kekelis, 2017).

Barriers to Scale

One challenge raised for numerous programs in the present study is an inability to serve girls longer or serve a greater number of girls by lengthening existing programs, running additional weeks for different participant groups, or conducting the program for a broader age range of participants, as well as reaching girls who have least access to these types of opportunities. McCombs et al. (2011) describe the barriers to scale for expanding programs. They assert that funding and facilities are primary concerns. For example, programs on university campuses report difficulty securing space during summer academic sessions (Wiest & Crawford-Ferre, 2017) and programs on K-12 campuses report challenges scheduling around summer cleaning schedules and ensuring that air conditioners are turned on (McCombs et al., 2011). Soto-Johnson (2017) also reports that raising the necessary funds for a summer program and follow-up sessions is the greatest challenge her OST program faces, citing the importance of a university development officer as critical for securing funding in a post-secondary institution. Funding is also a concern for K-12 school-based programs, which typically rely on federal flow-through funds that have decreased since 2014 (Augustine et al., 2016) and are required to pay teachers based on previously negotiated pay scales (Augustine & McCombs, 2015). Similarly, McCombs et al. (2012) identified cost as the primary barrier to implementing summer learning programs. To address funding concerns McCombs et al. (2012) suggest partnering with other OST programs to create economies of scale for purchasing. Human capital can also be in short supply as teachers experience burnout or have conflicts with required professional development trainings that occur during the summer (McCombs et al., 2011). The sample in this study might serve as a starting point for developing a network of OST programs with similar goals that could form partnerships for purchasing, planning, curriculum development, etc.

Socioeconomic Status

SES of participants and their families presents an additional challenge for OST STEM programs for females. Students have differential OST opportunities based on their family SES. Students from low-SES families, schools and neighborhoods learn less relative to their wealthier peers, possibly due to fewer academic opportunities during the summer (Augustine et al., 2016). Students from low-income families are more likely to watch television during the summer (Gershenson, 2013) and less likely to have access to high-quality OST programs (Covay & Carbonaro, 2010), with less than one-third of low-income youth participating in an organized summer activity (Augustine & McCombs, 2015). Even when participating in organized summer activities, low-income youth are less likely to have access to expanded, formal, enrichment activities and are more likely to receive remedial programming (Archer et al., 2010; Bevan & Michalchik, 2013). In this study, nearly all OST STEM programs for females surveyed report offering needs-based scholarships to some participants, with many programs offering full scholarships. Respondents indicated that barriers to socioeconomic diversity in participation were due to challenges with outreach rather than a lack of opportunity due to the cost of the camp. For example, students of low SES might not be able to attend programs that include registration and transportation due to additional responsibilities at home.

Given the disproportionate participation by different student groups, some programs specifically provide outreach to diverse youth. Thiry, et al., (2015) describe purposeful recruitment of diverse participants:

> High numbers of underrepresented minority (URM) youth or girls did not show up in OST SET programs simply by happy accident. An urban location and a diversity-oriented mission statement help to enhance URM youth participation, but were not enough to

> ensure diversity. Rather, successful programs enacted their mission statement through their recruitment practices and program design. (p. 22)

Similarly, Davis and Hardin (2013) describe a Florida camp that targets schools with a high percentage of students receiving free and reduced-price lunch in their recruitment planning.

Programs also report challenges with attendance and completion of low-income youth. Wiest and Crawford-Ferre (2017) report that often some girls drop out of the camp until the day the camp starts and sometimes into the first few days of the camp. McCombs et al. (2011) further note that low-income youth do not attend as much of voluntary programs as their more affluent peers. Transportation is a frequently reported challenge for low-income youth, so some programs arrange and provide transportation. For example, some programs provide girls with metrocards and pay bus and subway fares (e.g., Houck et al., 2017). This challenge was also raised by respondents in this study, with one program reporting a failed attempt to provide payment for public transportation options. In this case, participants struggled to find the correct busses, make connections and bring the correct permission slips with them to camp. Low-income students also miss days of camp to care for younger siblings or work a job to contribute to the household (Davis & Hardin, 2013). Programs should consider offering multiple grade levels, including those for very young children, to minimize the need for older siblings to miss camp to provide childcare. This is particularly relevant to all-girls camps, as girls are more likely to miss school to provide childcare (East & Hamill, 2013). Substantial and sustained attention to SES in OST programming is key, given the potential for these inequities to further widen the achievement gap (Wimer & Gunther, 2006).

Intrapersonal and Interpersonal Skills

Wiest et al. (2017) say, “These problems [with intrapersonal/interpersonal skills] mainly involve difficulties some girls have adjusting to the program setting (e.g., experiencing homesickness, learning to interact with a variety of girls, or forming personal connections with peers), behavior issues, and weak self-concepts” (p. 250). In this study, behavior management, particularly for programs that include traveling with students on field trips and managing externships, was stated as a challenge. To address intrapersonal and interpersonal concerns, some suggest hiring additional staff who have time to focus on student behavior, including using icebreakers, promoting cooperation, engaging girls in candid conversations about diversity, and including parents in conversations about diverse partners and roommates (e.g., Augustine et al., 2016; Kekelis, Ancheta, Heber, & Countryman, 2005).

Additional Implications

Unintended Positive Consequences for Staff

A consistent theme was the perceived benefit to individuals other than the girls enrolled in the OST program. For example, Soto-Johnson (2017) describes how one OST STEM program for females also provides a venue for professional development, saying:

> The staff is open to inviting teachers to serve as apprentices to the faculty so that they may observe and participate in IBL [inquiry-based learning] teaching methods. This would also give teachers a chance to witness how the faculty challenge but encourage the young women in such a way that instills a desire to learn college-level mathematics, the gateway to all STEM fields. (p. 22)

Additionally, OST STEM programs for females provide opportunities for graduate student volunteers to teach and gain research experience (Erchick, 2017) and opportunities for participating teachers to build confidence and capacity, with teachers reporting improved ability to engage girls in STEM projects, increased knowledge and awareness of STEM projects, and greater awareness of technology resources and programs (Kekelis, 2017). This, in turn, impacts K-12 classroom instruction. For example, a teacher from the Techbridge program reports, “I incorporate more cooperative and hands-on learning in my regular class, run less scripted and more open-ended lessons, because of what I’ve learned about student learning from Techbridge” (Kekelis, 2017, p. 73).

Other programs are more purposeful with professional development opportunities. For example, Hodge, Matthews, and Squires (2017) describe a Noyce grant partnership that provided funding for six pre-service teachers to gain experience teaching as paid interns in a Eureka camp. Additionally, the National Governors Association (2012) reports that many informal science institutions hold week-long professional development opportunities integrated with OST camps to help teachers practice leading hands-on activities.

Secondary recipients potentially extend beyond staff. For example, Houck et al. (2017) identify over 200 people as secondary recipients to the OST programs for girls including parents, families, faculty, visitors, and members of the general public who attend a one-day event.

Unintended Positive Consequences for Program Directors

Many programs report working in relative isolation from other OST programs despite having similar goals, with comments such as, “I wish we could conserve our resources and work together instead of all trying to be islands.” Interviewees reported a perceived benefit from participating in the interview process as a form of reflection. For example, one participant commented on considering changes to their outreach, “We never really considered transportation, if there might be a demonstrated need, but that is definitely something we should consider." Another pondered changes to data collection processes,

> Gosh, I don't know the number of students that return. I've never really thought about it actually. That might be something to show that the program does have a continued impact. That's something I need to look more closely at.

This respondent also commented on potential improvements to current grant applications: "This has been great; you've given me a lot to think about for the grant applications that I'm working on." These unintended positive consequences for directors who consented to be interviewed might signal a need for professional learning communities to provide a venue to reflect upon efforts to support females in STEM through OST programming.

Theoretical Framework Revisited

I drew on positioning theory to frame and interpret this investigation of United States OST programming. Positioning builds one's identity through social interaction, and females frequently cite lack of a STEM identity as a reason they do not pursue STEM disciplines (Krishnamurthi et al., 2014). Given that individuals develop their identities through activities and social relationships with people and that researchers posit that these social encounters have significance and that people's social positions are important (Holland et al., 1998, Urrieta, 2007), it is logical that programs report a purposeful effort to develop positive STEM identities. Thus, this theory aligns with motivation to develop OST programs and was the motivation for this study.

Purposeful Identity Development

Programs in this study report purposeful attention to supporting girls in developing an identity as someone who belongs and identifies with STEM. This is supported by Archer et al.

(2010), who found that students' constructions of science were separated into two themes, "doing science" and "being a scientist," with many students describing a career in science as "unthinkable." Programs in this study sought to support girls in envisioning themselves as capable of having STEM careers. Research indicates that this positive STEM identity, including STEM career aspirations, better predicts a future STEM career, than high mathematics achievement (Krishnamurthi et al., 2014). Additionally, programs reported working to dispel the myth of innate talent and "math people," as these beliefs run counter to developing positive STEM identities for girls who believe they have to "work too hard." Archer et al. (2010) assert that there is a powerful discourse of "science people" and people with a "math mind" that is epitomized by effortless brilliance. These identities are often configured as male, with females configured as "diligent" or "hard working" (Archer et al., 2010). These identities are concerning and contribute to underrepresentation of females in fields where success is believed to require brilliance (Meyer, Cimpian, & Leslie, 2015). Purposeful support of positive identity development is a key suggestion for quality OST STEM programming for females given that "there is a large body of work that would indicate that a students' sense of self-identity is a major factor in how they respond to school subjects" (Archer et al., 2010, p. 618).

Conclusions and Directions of Future Research

OST programs have shown promise in addressing achievement gaps, and STEM OST programming for females have shown promise in increasing interest, positive affective dispositions, and knowledge of STEM careers. Despite commonalities, there is still high variability in OST program characteristics, including the demographics of girls they serve and their effort, or lack of effort, to target particular subpopulations. Summer learning opportunities, especially for underrepresented youth, must become a policy priority, given the potential for summer programming to widen (or narrow) the achievement gap (Houck et al., 2017). Additionally, the lack of reported acceptance criteria suggests opportunities for practitioners to pursue, such as programs for females are designed specifically for English Language Learners or have disabilities.

Although national organizations exist to facilitate collaboration, limited programs in this study are affiliated with national organizations. Additionally, they do no report collaboration with other STEM OST programs for females. Therefore, an opportunity exists to improve collaboration and shared resources. Additionally, despite advancement in evaluation for OST programming, evaluation is not standardized to allow for cross-program comparisons. This research contributes to this effort by determining key features, recommendations and challenges specific to OST programs for K-12 females and calls for greater funding with a special effort to engage underrepresented and underserved youth, while conducting program evaluations. In response to these contributions the following directions for future research are offered.

Longitudinal Research

Longitudinal studies are suggested most often in the research literature (Wiest et al., 2017). Only through longitudinal research can students be followed from summer camps into college and subsequently into careers (Mohr-Schroeder et al., 2014). Longitudinal research has the potential to determine whether participation in an OST STEM program for females played a role in a participant's personal, academic or professional life. Additionally, authors recommend that longitudinal studies should attempt randomized experimental trials that meet the "strong evidence base" requirements of the Every Student Succeeds Act to share with policy makers (Augustine et al., 2016; McCombs et al., 2012). McCombs et al. (2012) suggest that these studies track not only academic outcomes, but also reductions in "juvenile delinquency, improved nutrition, and increases in exercise. Including a range of outcomes will help motivate stakeholders, such as city governments, to support or fund" OST programs (p. 52).

Programmatic Decisions

Erchick (2017) notes the need for additional research in components of effective OST environments that build relationships, specifically "a) relationship with the content (mathematics); b) relationship with the pedagogy (the intersection of content, teaching and learning); and c) relationship with people (interpersonal relationships among participants and the intrapersonal relationship with the self)" (p. 32). This might require in-depth interviews with participants regarding girls' perceptions of favorable and unfavorable programmatic decisions. These perceptions might differ according to race/ethnicity, language, exceptionality, or family income, leading to a call for an investigation of intersections of participant identities.

Intersection of Identity

Wiest et al. (2017) call attention to the importance of intersectional research. Intersectional research might identify barriers in recruiting and retaining subpopulations of females in STEM and investigate potentially variable program influence on different girls. Further, without identifying who chooses to participate in OST STEM programs, it is difficult to understand the role of selection bias in outcomes. Ashcraft, Eger, and Friend (2012) note in relation to females and information technology:

> Beyond simply focusing on gender, consider the importance of intersectional research and programs that explore multiple intersections of youth's identities for computing pedagogy (e.g., race, class, gender, and sexuality). Diversity of voices and experiences will help not only in the production of richer research but also a richer U.S. computing work force. (p. 45)

STEM Ecosystems

Traphagen and Traill (2014) conceptualize OST STEM programs as one part of an "ecosystem" that includes home, school, OST programs and STEM-focused institutions such as museums. This ecosystem places the student at the center, with resources such as OST programs and science centers organized around them. Bevan and Michalchik (2013) assert that an ecosystem helps students to develop interests over time and that research is necessary to determine how these social arrangements and opportunities, or lack of opportunities, support STEM interest and learning. Additionally, research is needed to address the role of OST programs in creating an "ecosystem to help girls envision and explore a career path, develop grit needed for a career in STEM, and garner support along the way" (Kekelis, 2017, p. 77). There is also room for research on how partnerships for OST programs are encouraged, funding is allotted towards a shared goal, and roles are assigned among partners (Krishnamurthi et al., 2014). This careful reflection regarding shared goals might also address duplicative efforts and thus reduce the required resource allocation. Greater collaboration among OST programs might additionally provide coordinated programming to better serve girls in STEM (Kekelis, 2017). These community partnerships might reduce competition, result in shared resources and maximize potential (Wimer & Gunther, 2006).

OST Programs as Staff Development

Numerous programs reported perceived positive unintended consequences for staff working in OST STEM programs for females. However, little is published regarding formalized professional development embedded within these programs (e.g., National Governors Association, 2012). Based on this limited research, I propose the following questions: What are the experiences of staff teaching in K-12 OST programs for females? What is the role of content and pedagogical content knowledge for various types of staff members? What can we learn about co-teaching models between STEM industry professionals and professional educators?

Final Thoughts

This study contributes to the effort to map the field of OST, by adding programs that specifically target K-12 females in STEM disciplines. It represents 115 website reviews, 51 survey responses and six interviews with program directors from 38 states. Additionally, it represents all grade levels K-12 and a variety of residential and day-only programs. The majority of programs in this sample are individual programs, not affiliated with national OST professional organizations. This study shows the potential for and promise of programs with similar missions to collaborate, share information and make a concerted effort to improve outcomes for females in STEM fields.

Appendix A

Websites Reviewed

Name of Program	URL for Website of Program
Action Science Camp for Young Women	http://learnmore.duke.edu/youth/action
Adventures In STEM	http://curent.utk.edu/education/pre-college/adventures-in-stem-camp/
Aim for the Stars	http://aimforthestars.unomaha.edu/.
Alexa Tech	https://www.idtech.com/alexa-cafe/
All Girls/All Math Summer Camp	http://www.math.unl.edu/programs/agam
Art2STEM	http://portal.alignmentnashville.org/documents/10179/212263/Art2STEM+Replication+Guide/47829b39-fc28-465b-a4d5-b09b61b3f96b
Aspirations in Computing	https://www.ncwit.org/project/aspireit-k-12-outreach-program
Awe-Sum Summer Camp	https://www.westminstercollege.edu/campus-life/camps
B-WISER Summer Science Camp	http://bwiser.spaces.wooster.edu/
Berkley Girls in Engineering	http://girlsinengineering.berkeley.edu/contact.html
Black Girls Code	http://www.blackgirlscode.com
Built by Girls	https://builtbygirls.com/
Build IT	http://buildit.sri.com/
California Girls in STEM (CalGirlS)	https://ngcproject.org/collaborative/california-girls-in-stem-calgirls-collaborative
Camp KAOS	http://cosmo.org/explore/camps
Camp Reach	https://www.wpi.edu/academics/pre-collegiate/summer/stem-overnight/camp-reach
Center for STEM Education for Girls	http://www.stemefg.org/index.php/about-us/
Coastal Studies for Girls	https://www.coastalstudiesforgirls.org
College Journey Camp 4 Girls	http://www.gsnetx.org/en/events-repository/2015/college-journey.html.html
College of Engineering's Women's Engineering Exploration WE2	https://engineering.temple.edu/summer-programs/summer-we2
CompuGirls	https://cgest.asu.edu/compugirls
Count me in	http://countmeinmath.com/
Curious Jane	http://www.curiousjanecamp.com/check-it-out
Dads and Daughters Do Science	https://www.ndsu.edu/coe/k_12_outreach/stem_k_12_fall spring_offerings/dads_and_daughters_do_science_dadds/
Design, Connect, Create	http://www.designconnectcreate.org/camp-info

DigiGirlz	http://www.microsoft.com/en-us/diversity/programs/digigirlz/hightechcamp.aspx
DiscoverE	http://www.discovere.org/our-programs/girl-day
Duke University FEMMES	https://sites.duke.edu/femmes/
Earth Camp	http://www.earth.lsa.umich.edu/earthcamp/
ECO Girl	http://sdowp.mst.edu/womenindex/summercamps/girlsgogreen/
Engineer Girl	http://www.engineergirl.org/
Engineering mini-camp for high school girls	http://www.widener.edu/academics/schools/engineering/outreachprograms/hsgirlsminicamp.aspx
Eureka-STEM!	http://www.unomaha.edu/college-of-education/office-of-stem-education/community-engagement/index.php
Excite Camp Hawaii	http://www.womenintech.com/programs/excite-camp%E2%80%A8%E2%80%A8/
Excite Camp Kansas	http://www.k-state.edu/excite/
Expanding your Horizons Utah	http://www.uvu.edu/wsc/
First Bytes Summer Camp	https://apps.cs.utexas.edu/camp/firstbytes
Fun with Chemistry Camps	http://ice.chem.wisc.edu/Camps.html
GEMS	http://www.gemscamp.org
GILDIT	https://www.ncwit.org/programs-campaigns/aspirations-computing
Girls Adventures in Mathematics, Engineering, and Science (GAMES)	http://engage.illinois.edu/entry/28378
Girls Engineer Maine	http://umaine.edu/gem/
Girl Engineering	http://www.uta.edu/engineering/girlscamps/
Girls Get SET	http://engineering.tufts.edu/ggs/index.html
Girls in FIRST	http://www.firstnevada.org/home.aspx
Girls in Science	https://www.sciowa.org/engage/girls-in-science/
Girls in Science	http://gsmit.org/girlscience.html
Girls Make Games	http://girlsmakegames.com/index.html
Girls only make-a-thing	http://kysciencecenter.org/kids/makerplace/
Girls Researching Our World	http://www.k-state.edu/grow/
Girls Rock Math	http://www.girlsrockmathematics.com/
Girls Scout STEM sampler	http://www.gsnetx.org/en/events-repository/2016/stem_summer_series_s_0.html
Girls in STEM	http://www.girlstart.org/our-programs/girls-in-stem-conference?id=136
Girls in STEM at Tulane	http://www2.tulane.edu/sse/outreach/gist/
Girls in STEM Keystone Science School	http://www.keystonescienceschool.org/education-programs.html
Girls Only STEM Day	https://www.usna.edu/STEM/applications.php#stem2
Girls Plus Math	http://www.wiu.edu/sao/outreach/youth_enrichment/math

	camp.php
Girls Tech	http://greenapplecampus.org/girlstech/
G.R.A.D.E Camp	https://www.egr.uh.edu/grade/about
GRASP	http://www.physics.ohio-state.edu/undergrad/GRASP/index.html
Greater Opportunities Advancing Leadership and Science (GOALS) for Girls at the Intrepid Sea, Air & Space Museum	http://www.intrepidmuseum.org/GOALSforGirls.aspx
It's a Girl Thing	http://sdowp.mst.edu/womenindex/summercamps/itsagirlthing/
Las Chicas de Matematicas: UNC Math Camp	http://www.unco.edu/nhs/mathsci/mathcamp/
Latinas Code Chica Conference	http://laslatinitas.com
Lincoln University Sonia Kovalevsky Math for Girls Day	http://bluetigercommons.lincolnu.edu/mathday4girls/7/
Magic	http://getmagic.org/about.html
Make the Machine	http://www.engr.psu.edu/wep/MTM.html#whatisMTM
Math is for Girls	http://www.mathisforgirls.org/.
Math Prize for Girls	http://mathprize.atfoundation.org/index
NASA Girls	https://women.nasa.gov/nasagirls/
Northern Nevada Girls Math and Technology Camp	https://www.unr.edu/girls-math-camp
Rosie's Girls	http://rosiesgirls.org/
Saturday Academy Programs for Girls	http://www.saturdayacademy.org/more/girls
Saturday Science Club for Girls	http://www.rhfleet.org/learn/saturday-science-club-girls
Science Club for Girls	http://www.scienceclubforgirls.org/overview
Science: It's a Girl Thing	http://www.depts.ttu.edu/diversity/ideal/science_girl_thing.php
Search	https://www.mtholyoke.edu/proj/search/Contact.html
Sisters in Science	http://www.sistersscienceclub.org
Smart Girls Summer Camp	https://atlantagirlsschool.org/smart-girls-camp/
Smarter Girls Summer Camp	http://www.smartergirls.org/contacts.html
Space Center Houston	http://spacecenter.org/outreach/girls-stem-academy/
Spectacles	http://www.wesleyancollege.edu/community/campsandyouthprograms/spectacles.cfm
St. Olaf College Engineering and Physics camp	http://wp.stolaf.edu/conferences/summer-camps/physics-camp/

STAR Science through arts and rhythm	http://www.mainegirlsacademy.org
STEM Chicks	http://stemchicks.org/
STEM Day for Girls	https://stem.nmsu.edu/stem-day-for-girls/
STEM Divas	http://niu.edu/stem/programs/divas.shtml
STEM Exploration Day for Girls	http://www.uwsp.edu/conted/ConfWrkShp/Pages/STEM/Girls.aspx
STEM for Girls	http://faculty.engineering.ucdavis.edu/jeoh/teaching/outreach/
STEM Girls	http://www.cincymuseum.org/STEMGirls
Stem Sisterhood	https://www.stuartschool.org/stem/stem-sisterhood-outreach
STEPS	http://www.stthomas.edu/stepscamp/
STEPs Grand Valley	https://www.gvsu.edu/steps/
STEPS Michigan	http://www.udmercy.edu/events/2016/07/11/steps-summer-program.php
STEPS Wisconsin	http://www.uwstout.edu/steps/
Summer Day Camp For Girls To Focus On Science	http://www.psu.edu/ur/archives/news/EMSshort.html
Summer Solutions	http://sdowp.mst.edu/womenindex/summercamps/summersolutions/
Tech Bridge	http://www.techbridgegirls.org
Tech Gyrls	http://ywca-sv.org/programs/TG/Techgyrls.php
Tech Gyrls - Boston	https://www.ncwit.org/programs-campaigns/aspirations-computing
TechGYRLS - Bristol	http://www.ywcalakecounty.org/site/c.bjJULfNPJiL6H/b.8330627/k.5CEB/TechGYRLS__TechTEENS.htm
Tech Gyrls Chicago	http://www.ywcachicago.org/our-work/economic-empowerment/techgyrls/
TechGYRLS - Green bay	http://www.ywcagreenbay.org/site/c.7nIGILOkG7IOE/b.9030963/k.F0EC/TechGYRLS.htm
TechGYRLS - NDSU	https://www.ndsu.edu/news/view/detail/14267
TechReach STEM	http://ngcproject.org/mini-grant/dayton-techreach-stem-clubs
Tech Savvy Conference	http://northhills-pa.aauw.net/tech-savvy/
Tech Trek! Science and Math Camp for Girls	http://aauw-techtrek.org
The Southern Colorado Girls' STEM Initiative	https://www.ppcf.org/education/girls-in-technology-girls-stem-fund/
Think about Math	http://www.cemc.uwaterloo.ca/events/tam.html
Twister	http://www.adventuresci.org/wp-content/uploads/2014/09/Twister_PresVol.pdf
UDayton Women in Engineering Summer Camp	https://www.udayton.edu/engineering/k-12-programs/women_in_engineering_summer_camp/index.php

University Summer Program for Women in Matheamtics	https://www2.gwu.edu/~spwm/
WISH: Women in STEM High School Aerospace Scholars	http://blog.stemconnector.org/nasa-women-stem-high-school-wish-aerospace-scholars-opportunity-deadline-approaching
Women Empowered by Science (WEBS)	http://www.wilkes.edu/webs
Women in Natural Science	http://www.ansp.org/education/programs/wins/apply/
Young Women's Science institute	http://wtp.mit.edu/application.html

Appendix B

"Mapping STEM OST Programs for Females in Grades Kindergarten to 12"

Study Interview Questions

Note: Questions will be driven by responses to the anonymous survey that participants complete. Survey responses that seem to require additional explanation will be incorporated into the interview questions. Further, the questions will be semi-structured in that participant responses deemed to require clarification or extension will be pursued to a greater degree during the interview session.

Interviewer Introduction

Thank you for agreeing to participate in an interview with me today. The responses you provide might help improve the OST STEM programs for females. I will appreciate your honest responses. Your name will be removed from your data, and responses across all interviewees will be collated. Any reported responses will be strictly confidential.

General questions likely to be asked include some or all of the following:

- Describe how you select staff
- Is your program evaluated? If so, how?
- How do you select the content in which your students engage?
- Is your camp a day or residential program and why?
- What ages of students do you target and why?
- What is the mission or goal of your program?
- Does your program contain a recreation portion? Why or why not?
- Have you faced any challenges in implementing your program, if so, what?
- What do you identify as key elements for a quality program?

Appendix C

Mapping STEM Out-of-School-Time Programs for K-12 Females

Welcome

Thank you for participating in my doctoral dissertation research. We are working to build a database of programs. Your responses will provide valuable insight into out-of-school-time (OST) science, technology, engineering and mathematics (STEM) programs for K-12 females. (This survey seeks information on single-sex female programs only.) This survey will take about 15-20 minutes to complete. You may skip questions you do not wish to answer or may choose not to participate. Your data is anonymous and will not be reported in any way that may identify you individually. You will be given the opportunity to volunteer to participate in a follow-up interview, which may or may not result in you being asked to do so. Participating in this survey or volunteering for an interview does not oblige you to participate in a follow-up interview. Your honest feedback is appreciated. If you are not the right person to complete this survey on behalf of your program, please have an appropriate person do so or email that person's name and email address to Heather Crawford (hcrawford@unr.edu).

If you have more than one program and wish to complete this survey separately for each program please use this link: https://www.surveymonkey.com/r/2KVZNNV

If you know of other programs that serve K-12 females in STEM that might be interested in completing this survey, please consider sending the appropriate contact information to Heather Crawford (hcrawford@unr.edu).

* 1. Risk/Inconvenience: Participating in this study involves little risk or inconvenience.

Benefits: **By completing this survey you will be entered to win a $50 Amazon gift card!** You might also experience satisfaction by knowing that your participation can help provide insight into STEM OST programs for females.

Anonymity: Your name will be provided for this study in order to track survey completers for the purpose of issuing reminders to those who have not yet participated. However, your name will not be linked to your survey responses because it will be downloaded separately from your survey data. Therefore, your participation is completely anonymous.

Questions and Contact Information: You may ask the researcher questions at any time by emailing Heather Crawford (hcrawford@unr.edu) or calling her at 775-682-7849. If you have any concerns about the conduct of the study, you may also call the Research Integrity Office, which oversees University of Nevada, Reno research, at 775-327-2367.

Voluntary participation: Your participation in this study is completely voluntary. You may discontinue the survey at any time. You may also choose to skip any questions.

If you complete this survey in a public location, close the web browser upon finishing. If you complete it at home, you might consider deleting cookies from your computer after finishing.

Do you consent to taking this survey?

2. Name of Organization Under Which Program Is Conducted

3. Location: City ___________State_________

4. Organization URL

5. Program URL (if different than above)

6. Please select the category that best fits the organization that oversees your youth program.

- ◯ Aquarium, zoo, or planetarium
- ◯ Museum or science center
- ◯ Non-profit organization
- ◯ University or college
- ◯ K-12 school district
- ◯ Private sector
- ◯ Government lab

Other (please specify)

[ ]

7. What is your role within the program? (select all that apply)

- [ ] Instructor or facilitator working directly with youth
- [ ] Coordinator or administrator supervising those who work with youth
- [ ] Director or manager of youth program(s)

Other (please specify)

[ ]

8. Name of Youth Program

[ ]

9. This program includes a substantial focus on the following STEM disciplines (select all that apply)

- [ ] Science
- [ ] Technology
- [ ] Engineering
- [ ] Mathematics

10. Does this program focus on a particular area within science, technology, engineering or mathematics (e.g. statistics, robotics, astronomy)?

11. Does this program include youth participants who are in (or entering) grades K-12?

12. Does this program take place entirely outside of school hours?

13. Does this program limit participation to females only?

14. Has this program existed for longer than one year?

15. The organization under which this program runs (select all that apply)

- [ ] Designed curriculum, materials or other content for this program
- [ ] Delivers this program's content directly to youth
- [ ] Hosts or provides physical space for this program

Other (please specify)

16. In what year was your program first offered?

17. Some youth programs are affiliated with multiple organizations. Does your organization partner with other organizations who provide curriculum, materials, content delivery, physical space, planning and/or feedback for this youth program?

18. If you partner with other organizations (do not include funders here), who is/are your partner(s)?

19. The indicated partner(s) (select all that apply)

- ☐ Provide curriculum, materials or other content for this program
- ☐ Deliver the program's content directly to youth
- ☐ Provide physical space for this program
- ☐ Contribute guest speakers, mentors, facilitators or other adult volunteers
- ☐ Contribute to planning
- ☐ Provide feedback

Other (please specify)

20. Location of partner: (City and State)

21. This program includes female youth enrolled in or entering the following grades (select all that apply)

- [ ] Kindergarten
- [ ] First Grade
- [ ] Second Grade
- [ ] Third Grade
- [ ] Fourth Grade
- [ ] Fifth Grade
- [ ] Sixth Grade
- [ ] Seventh Grade
- [ ] Eighth Grade
- [ ] Ninth Grade
- [ ] Tenth Grade
- [ ] Eleventh Grade
- [ ] Twelfth Grade

22. Participation in this program is limited to girls who are (select all that apply)

- [ ] Racial/ethnic minorities
- [ ] Youth with disabilities
- [ ] Gifted and talented youth
- [ ] Low-achieving youth
- [ ] No restrictions

Other (please specify)

23. What do you consider when accepting youth to the program? (select all that apply)

- [ ] Academic transcript
- [ ] Application
- [ ] Enthusiasm, excitement, interest
- [ ] Essay or personal statement
- [ ] Grade-point average
- [ ] Lack of other access to STEM education
- [ ] Letters of recommendation
- [ ] Personal interview
- [ ] Previous science-related classes
- [ ] Previous math-related classes
- [ ] School attendance record

Other (please specify)

24. How do you track youth participation demographics in this program annually?

25. In the past year, what percentage of youth participants in your program have identified as (estimate if necessary)

% African-American or Black

% American Indian or Alaska Native

% Asian or Pacific Islander

% Caucasian or White

% Hispanic or Latino

% Multi-racial

% Other

26. How does your program recruit or advertise the camp? Also describe any special effort for underserved youth.

27. Choose the description closest to your program's fee structure.

- ◯ Youth pay something to participate in this program (even if only application fees).
- ◯ Youth may participate in this program at no cost.
- ◯ Youth are paid or receive a stipend to participate in this program.

28. If youth pay to participate in this program (select all that apply).

- ☐ The program offers full scholarships to some participants
- ☐ The program offers partial scholarships to some participants.
- ☐ This program does not offer scholarships.

29. The total amount paid by a participant who has not received a scholarship (e.g. $400 per week).

30. From the start of the program, what is the total length of a typical participant's involvement with this program overall?

31. From the start of the program, what is the total length of a typical participant's involvement with this program within a one-year period?

32. Which of the following descriptions best fits your program's structure?

- ◯ Youth meet on a set schedule (e.g. after school, summer camp)
- ◯ Youth set their own hours or sign up for participation periods (e.g. internship, volunteering)

Other (please specify)

33. On a typical week during the academic year, for how many hours do youth meet on each of these days?

Monday

Tuesday

Wednesday

Thursday

Friday

Saturday

Sunday

Other (e.g. this program is NOT offered during the academic year)

34. Do youth attend any additional meetings outside the regular schedule (e.g., a field trip, final competition or presentation, etc.)? If yes, what are the total contact hours in addition to the regular weekly schedule?

35. During how many weeks per academic year is the program offered?

36. During how many weeks per year does the typical participant attend?

41. How many adult staff and volunteers who facilitate my program:

...have a background in science, technology, engineering or mathematics	
...have a background in education or youth development	
... are permanent paid staff	
...are volunteers	
...receive initial training	
...receive ongoing professional development	

42. Within your program, what STEM professionals outside your organization do youth participants interact with (select all that apply)

- [ ] None
- [ ] K-12 teachers
- [ ] University professors or researchers
- [ ] Industry STEM professionals
- [ ] Medical/health professionals
- [ ] Government researchers from government labs

Other (please specify)

43. Tell us about your program evaluation (select all that apply)

- [ ] No evaluation
- [ ] Internal evaluation by my own organization's staff
- [ ] External evaluation by someone outside my organization
- [ ] Evaluation efforts are in progress

Other (please specify)

44. Is your organization or program a member of any wider networks or professional organizations (e.g., Afterschool Alliance)?

45. Do you have public funders (e.g., U.S. Department of Education)? If yes, please list public funders

46. How is your program funded?

% Public funding

% Private individual donations funding

% Participant paid funding

% Private foundation funding

Comments/Other

47. Does your organization receive funding through the U.S. Department of Education's 21st Century Community Learning Centers program?

48. *Note: The information you provide here will not be linked to your survey and will be downloaded separately.*

If you are willing to support my doctoral dissertation by being interviewed about your program, please provide:

Your name

Email address(es)

Your phone number(s)

Name of your program

Appendix D

University of Nevada, Reno

Research Integrity Office
218 Ross Hall / 331,
Reno, Nevada 89557
775.327.2368 / 775.327.2369 fax
www.unr.edu/research-integrity

DATE:	August 23, 2016
TO:	Lynda Wiest, Ph.D.
FROM:	University of Nevada, Reno Institutional Review Board (IRB)
PROJECT TITLE:	[947096-1] STEM Out-of-School time Programs for Females in Grades Kindergarten to 12
REFERENCE #:	Social Behavioral
SUBMISSION TYPE:	New Project
ACTION:	DETERMINATION OF EXEMPT STATUS
DECISION DATE:	August 23, 2016
REVIEW CATEGORY:	Exemption Category #2

The Research Integrity Office, or the IRB reviewed this project and has determined it is EXEMPT FROM IRB REVIEW according to federal regulations. Please note, the federal government has identified certain categories of research involving human subjects that qualify for exemption from federal regulations.

Only the Research Integrity Office and the IRB have been given authority by the University to make a determination that a study is exempt from federal regulations. The above-referenced protocol was reviewed and the research deemed eligible to proceed in accordance with the requirements of the Code of Federal Regulations on the Protection of Human Subjects (45 CFR 46.101 paragraph [b]).

Reviewed Documents

- Letter - Survey Email (UPDATED: 08/17/2016)
- Other - Survey (UPDATED: 08/18/2016)
- Protocol - Exempt 2 (UPDATED: 08/17/2016)
- University of Nevada, Reno - Part I, Cover Sheet - University of Nevada, Reno - Part I, Cover Sheet (UPDATED: 08/15/2016)

If you have any questions, please contact Nancy Moody at 775.327.2367 or at nmoody@unr.edu.

NOTE for VA Researchers: You are not approved to begin this research until you receive an approval letter from the VASNHCS Associate Chief of Staff for Research stating that your research has been approved by the Research and Development Committee.

Sincerely,

Richard Bjur, PhD
Co-Chair, UNR IRB
University of Nevada Reno

Janet Usinger, PhD
Co-Chair, UNR IRB
University of Nevada Reno

Generated on IRBNet

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