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ESTABLISHING THE PUBLIC LIBRARY AS AN OUT-OF-SCHOOL PARTNER IN STEM/STEAM EDUCATION

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ESTABLISHING THE PUBLIC LIBRARY AS AN OUT-OF-SCHOOL PARTNER IN STEM/STEAM EDUCATION

A Project

Presented to the

Faculty of

California State University,

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In Partial Fulfillment

of the Requirements for the Degree

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in

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by

Gwyneth Sarina Fernandez

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ABSTRACT

The American public library is a unique community presence that positively influences the lives of families as an out-of-school partner in education. By examining the public library through a systems lens using Bronfenbrenner's Bioecological Theory the impact of these institutions may be seen. A key characteristic of public library service is timely, relevant adaptations that meet the needs of the community served. In this project, a recent public library pilot program is evaluated. This program was created in response to the emerging trend in Science Technology Engineering Art and Math (STEAM) within schools and informal education opportunities. It was found that the program received a positive reception from the community and that the library in question was considered a valued educational resource by the program attendees. Overall, the results of the program evaluation demonstrate the community's positive perception and appreciation of the library's program offerings. The limitations and potential areas of further research within the overlapping field of library service and K-12 education are discussed.

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CHAPTER ONE

INTRODUCTION

Public Libraries as Partners in Education

Libraries have a unique community appeal for residents and prospective residents. It has been shown that proximity to libraries increase property value ("Added Value to Homes", 2011) and for young families, the library provides a source of early education and is a positive community influence upon their lives (Payne, 2013, Miller et al., 2013, School/Public Library Cooperative", 2017). In fact, libraries and families may be seen as interconnected systems from a bioecological perspective. (Bronfenbrenner, 1979, 1986, 2005 White et al., 2014). Since the establishment of the American public library, the goal of these institutions has been to provide a level foundation of access to knowledge and resources which encourage lifelong learning ("Declaration for the Right to Libraries", 2013).

Libraries' attentiveness to the needs of their community have created a rapport between libraries and residents, thus allowing libraries to craft relevant, responsive services to their patrons (Gross, 2013, Lopez et al., 2016, Braun et al., 2014). As an intentional partner in education, libraries are responsive to trends and mindful of the needs of the familial unit (Early Learning with Families 2.0, 2020). In recent years, the responsiveness of the public library has been seen in the evolution of their services, based upon educations trends. The presence of **S**cience **T**echnology **E**ngineering and **M**ath (STEM) programs have

been indicative of these trends. Further, the recent inclusion of Art has transformed this acronym into STEAM programming. The responsiveness of the library in regard to educational trends has been noted in the increase in STEM/STEAM programs offered by libraries (Stevenson, 2014, Digital Inclusion Survey, 2014, "School/Public Library Cooperative", 2017). The benefits of STEM/STEAM learning have been noted in the education field, and as a partner in education, libraries are addressing these new trends by fleshing out relevant services (Kazakoff et al., 2013, Resnick et al., 2006, Thunberg et al., 2017). Libraries are uniquely positioned to provide families with community experiences of STEM/STEAM principles while acting as a bridge between children's informal, out-of-school-time education and their formal education (Steelband et al., 2017).

Libraries' establishment as a partner in education, a relevant community resource, and an impactful influence within the familial unit allows a greater understanding of the holistic approach to serving families. That said, libraries need support in providing such programming to young children and their families. This project focuses on how one library used such support and its efforts to gauge the usefulness of the support provided.

Libraries: An Important Civic Service

For many adults, choosing a city to make a home in is a heavily weighed choice. The state, city, or neighborhood that you settle down in could impact the rest of your life. Will you meet your life partner here? Start a family? Send children off to school? Will this city offer enough to keep you satisfied? It is

acknowledged that, for some adults, there is less choice involved in where they settle, depending upon their circumstances. Regardless of how a family ends up in a community, the viability of the environment must be considered. At the core, whether the community will provide sustainable life and opportunities is vital.

The significance of choosing the right area to settle in – whether raising a family or not, is demonstrated by the importance placed upon real estate locations and their proximity to desirable features such as recreation activities, preferred grocery stores, parks, etc. For families determining where to settle, both the presence of and proximity to the local library may factor into their decision. In 2011, the American Library Association (ALA) found that homes in the Philadelphia area within ¼ mile of a library were worth, on average, $9,630 more than homes that were over ¼ of a mile from a library ("Added Value to Homes", 2011). The community library offers a point of connection, especially for new families. It becomes the place where they build relationships with families they might never encounter within their usual spheres. For many young families, the library provides them their first experiences with early education (Payne, 2013), as they make use of suggested reading lists, library collections of parenting materials, and robust programming (Miller et al., 2013). As an intentional partner in education, the public library is a significant element of city services that can influence a family's decision when choosing a neighborhood.

Urie Bronfenbrenner's Bioecological Systems model can be used to examine the importance of city services to quality of life, including the role of the

library. Systems theories assume that elements of a system are interconnected, systems should be understood as wholes, and each system can affect itself through environmental feedback. The most efficient and superior systems are those that connect with others to provide a comprehensive understanding of environmental impact, such as the positive impact that city services have on their residents' quality of life (White, et al., 2014).

Bronfenbrenner's Bioecological Theory. Bronfenbrenner states that an individual's behavior is an interaction between their traits and abilities within their unique environment. The theory is also applicable to a family unit, considering the household unit of adult(s) and child(ren). By exploring each level of a family's environment according to the bioecological model, further understanding of environmental impact can be gained in the context of family traits and characteristics. The bioecological model proposes that the child (or in this case, the family) is at the center of the system and exists within layered systems, which can interact with one another (Bronfenbrenner, 1979). The systems outlined in the bioecological model begin with the familial unit or the individual in the center, surrounded by nested systems.

At the center, immediately surrounding the familial unit is the **microsystem**, comprised of the environment that the family experiences directly. Following that is the **mesosystem**, a layer comprised of the connections that occur between elements in the microsystem layer. For example, how schools and city services experienced directly by the family, work together. Next is the

macrosystem, referencing the overall cultural context in which a family lives and may include beliefs, cultural values, or geographical influences. Finally, the **chronosystem,** a later addition to the model by Bronfenbrenner in 1986. This system references the changes that occur over time in both the family's immediate microsystem and within each of the additional layered systems (Brewein & Statham, 2011, Bronfenbrenner, 1979, 1986, 2005)

A key consideration when applying the Bioecological model to families is the interconnected elements of the systems. Young families do not exist in a vacuum and are continuously affected by, and adapting to, occurrences within and between the various systems. The significance of the environment and its impact upon families, in this case the community in which they live, is necessary to consider when examining the holistic growth and development of the familial unit (White et al., 2014). Cities are beginning to apply this understanding and alter their services accordingly to provide enriching experiences for residents in response to the needs of their community. For some municipalities, this may include conducting community workshops, health seminars, and community needs assessments to accurately interpret the wants of their residents, leading to superior civic service and desirable community resources (National Civic League, 2020).

Efficient systems are interconnected and work together (White et al., 2014). Within the scope of a city, the best services are also interconnected and provide residents with services that interact with one another, considering the

needs of various aspects of the environment. Libraries are an excellent example of a well-honed city service (“Libraries and Community Engagement”, 2014). Since their inception, American public libraries have attempted to provide relevant services which consider the overall needs of their patrons (Garrison, 1979). For young families, education and access to educational resources poses a significant need. Libraries have worked continually to understand these needs and partner with formal education systems to provide the best experiences for patrons (“School/Public Library Cooperative”, 2017). Libraries exist primarily in the mesosystem and microsystem of family units and demonstrate the interactions that occur within systems and the direct influence wielded within the microsystem. Within the microsystem, libraries influence directly impact families through programs, resources, materials, and reference services. Each of these items, enacted by individual library staff interactions, has an impact upon the familial unit. At the mesosystem level, libraries foster connections among the familial unit and their formal education system by acting as a partner in education and providing out-of-school-time educational resources. Libraries excel in these areas due to their robust history and enduring mission of serving the public (Henderson, 2009).

The American Public Library

Libraries are ingrained in the culture of the United States. Libraries’ contribution to their communities have been noted, as has the establishment of

the library as a place that provides access to all (Nishi, 2011). Since the creation of the American public library, these institutions have been committed to serving as a source of education and access for all. Initially, the idea of access for all took the form of access to information. Although only limited records of the country's earliest public libraries exist, the American Library Association estimates that the first American public library was the Peterborough Town Libraries, founded in 1833. These libraries were the first municipal institutions created with the intent to provide free library access for all ("Before 1876", 2020). In early American public libraries, this simply meant access to written materials such as books, almanacs, newspapers, etc. The library was a physical destination with core values built upon good citizenship with the library lending model. Library patrons were entrusted with library materials, with the agreed upon understanding that they would return these items, thus allowing access for anyone who wished it (Garrison, 1979).

American public libraries have withstood the test of time and continue to maintain their societal relevancy nearly 200 years after the Peterborough Town Libraries. This is due, in part, to the fact that libraries are transformative in their very nature and continually adapt to the informal education and access needs of the communities they serve by providing access to educational resources and learning opportunities for all (Gross, 2013). One such focus in recent years has been on family services and working in conjunction with educational systems to provide STEAM programs (e.g., programs that encourage children's science,

technology, art, and math skills). To illustrate this, surveys conducted by the American Library Association in 2013 and 2014 found that one third of public libraries (36%) offer afterschool children's programs and 34% offer STEAM programs (Digital Inclusion Survey 2013 & 2014).

The Role of the Library in Family Life

Public libraries have contributed to family engagement for decades. An important aspect of public libraries is programming which serves children and families. As a partner in education, libraries aim to meet the needs of their community by providing robust, relevant programming. One such example is the Waukegan Public Library in Illinois, with a fifty-seven percent Latino community. Waukegan Public Library meets their community needs by serving as a trusted resource, providing bilingual storytimes for families and ESL conversational programs (Lopez, et al., 2016). Libraries aim to serve their intergenerational communities by proving programs and resources to appeal to individuals of any age. For young families, early learning storytimes and parent workshops are offered. For families with school-aged children, afterschool enrichment programs, tutoring, and other offerings are available. For many teens, their public library becomes a safe haven where they can access information that helps to address their many questions, provides a safe social experience, and may even provide early professional experiences as library volunteers or part-time workers (Braun et al., 2014).

As the family evolves, libraries continue to meet the needs of the family as a whole and of each family member. Throughout young children's development, the library serves as a community meeting place, connecting parents who may feel isolated, with others' undergoing similar experiences (Early Learning with Families 2.0, 2020). In a recent white paper published by the Association of Library Service to Children, a subdivision of the ALA, the Project LOCAL (Library Outreach as a Community Anchor in Learning) study was discussed. Project LOCAL examined how public libraries are expanding their services to reach families in underserved communities. The findings of Project LOCAL emphasize the role of the library as a cultivator of relationships and community partnerships ("Engage, Cultivate, Provide, Assess", 2019). These partnerships allow the library to be a responsive provider, adjusting to meet the needs of young families by considering the influence of surrounding systems, such as educational demands for access, or the familial need for support as a child undertakes a new learning system or structure.

Libraries are a community draw for young families looking to gain access to educational resources. In a report summarizing findings from the Pew Research Center's Internet and American Life Project, researchers found 94% of parents believe that libraries are important for their minor children. Young families are also more likely than single adults with no children to utilize library resources. Young families are reading to children to provide early educational experiences – and this is where the library comes in. Access to books is

extremely important to young families, as the Internet and America Life Project found that 84% of families read multiple times a week with their children, with many in that group reading with their child every day. These parents also stated that libraries help to inspire their children's love of reading and books. An overwhelming 97% of parents say that it is important for libraries to offer programming for minors (Miller et al., 2013).

Libraries' Attention to Educational Trends

Libraries are a partner in education and serve as an out-of-school resource for both families and educators ("School/Public Library Cooperative", 2017). As such, libraries are invested in understanding trends within complementary systems that impact the needs of their patrons. This attention to factors that impact children and families has resulted in libraries continuing to alter their services to meet the changing needs of their clients. One significant area of growth over the last seventy years is the increased emphasis on STEM education. This growth has altered landscape of the library; as the importance of STEM has risen, libraries have worked to adjust their offerings to meet the demand for technology access and STEM experiences.

Brief History of STEM Within the United States

The National Science Foundation (NSF) was founded in 1950 with the directive to foster research and education in the scientific fields of: biology, engineering, mathematics, physics, and other sciences. The work of the NSF was intended to evaluate and inform scientific research undertaken by

government agencies. Additionally, the NSF would support civilian science through grants related to “medical research; mathematical, physical, and engineering sciences; biological sciences; and scientific personnel and education” (“A Brief History”, 1994). Throughout the first five years of its’ existence, the NSF established research programs and expanded science educational opportunities in the United States.

In 1957, the Soviet Union’s launch of Sputnik brought to light the competitive nature of the United States. According to Stevenson (2014), the launch of Sputnik inspired fear in the United States, as the Soviet Union “conquering” space was considered a threat to both the economy and homeland security. In response, Congress substantially increased funding to the NSF and science-related education. Since the 1950s there has been a continual “alarm, boom, and bust” cycle of STEM education’s rise and fall in significance in the United States. The rise in STEM importance often starts with a new stride in the sciences by another country, prompting the United States to react and sound the alarm that there is an existing shortage of STEM expertise within the country (Teitelbaum as quoted in Charette, 2013).

In the 1980s, the alarm was raised when a perceived shortage of science professionals prompted a re-evaluation of the United States’ STEM education in comparison with other countries (Stevenson, 2014). The resulting worry, as well as great strides made in computer science during the time, prompted an increase in science education for K-12 students (“A Timeline of NSF History”). The 1990s

demonstrated a further push for education in the sciences, specifically in Information Technology, as access to the internet became commonplace. This push for technological expertise in the K-12 system extended to libraries as well, especially regarding the provision of STEM programming for children and families.

Recent STEM/STEAM Trends

Within the last decade, the demand for science education has hit a boom in its' cycle and is now emphasized in educational settings from early childhood education to college-level coursework and beyond (Small, 2018). This demand has been prominent throughout the country in school curricula, due to an increase in attention given to the necessity of science learning environments. In 2013, the Next Generation Science Standards (NGSS) for K-12 STEM education were unveiled as a multi-state collaboration. These standards, which aim to provide students with both theoretical and practical science practices were adopted by states over the next two years. The NGSS aimed to provide an integrative learning experience for children throughout their early academics by partnering scientific content with the relevant critical thinking and communications skills necessary for success within the sciences. During President Obama's administration many strides to support experiential learning of sciences were made including an increase in funding for STEM education, targeted Department of Education guidance to educational organizations, and a

commitment to increase STEM learning opportunities for young children through collaborative family engagement activities (“Fact Sheet,” 2016).

As K-12 education and beyond has become more interdisciplinary, the rise of *STEAM* education, with the added A for “Art” has become apparent (Young Audiences Organization, 2013). The push for the incorporation of the arts into the STEM fields was championed by John Maeda, the previous president of the Rhode Island School of Design (RISD), who made a passionate case that the integration of art and design into science, engineering, and beyond would help bring America into the 21st century (Maeda, 2013). The transition to STEAM education calls for a focus on the interconnectedness between disciplines and specifically, the value of incorporating creativity into subject matter that was previously considered completely disparate from the arts (Guyotte, et al., 2014, Bequette & Beqeutte, 2012). A unique benefit of the transition to STEAM is the perceived value of STEAM education as a preparatory experience for students to understand the transdisciplinary “real world” and the anticipated future need for students to address problems regarding the changing world, including, but not limited to: climate change, marine environments, and sustainability (Guyotte, et al., 2014).

The Benefits of STEM/STEAM

Young children learn through their experiences and interaction with their environment (Miller, 2011). Jean Piaget proposed that children entering the concrete operational stage can reach higher level thinking by conquering the

principles of reversibility and logic, which often occurs through exposure to these operations (Miller, 2011). STEM/STEAM learning experiences are the epitome of this – hands-on learning, which allows students to directly interact with materials that help create representations for the STEM principles. For example, computer programming in an early childhood environment provides opportunities to work on creativity, design, planning, problem-solving, sequencing, and vocabulary skills as children experience the lesson with the assistance of an adult (Kazakoff et al., 2013, Resnick et al., 2006).

Kazakoff et al. (2013), assessed the impact of a one-week intensive robotics workshop in an early childhood center on young children's story sequencing skills. The study utilized a developmentally appropriate programming interface that offered both tangible programming with wooden blocks and graphic programming on screen. Participants were tested pre-and-post intervention and results demonstrated a significant increase in the students' story sequencing skills after an intensive one-week intervention. These skills are applicable across educational domains, including mathematics and early literacy, demonstrating the interconnectedness of STEM education (Kazakoff et al., 2013).

In the United States, the push for STEM education is present at all levels of the education system. During the early elementary years, many young girls demonstrate a decline in their perceived ability in the sciences and stereotypical gender gap exhibited by their perception that boys are better at computer science and engineering (Ceci & Williams, 2010). These STEM-gender stereotypes lead

to a negative impact on young girls' performance in STEM and later in adult performance in STEM (Thoman et al., 2013). In a recent study conducted by researchers at the University of Washington, gender stereotypes in six-year-olds regarding computer science and engineering were compared to their stereotypes about the STEM fields of math and science (Master et al., 2017). Further, researchers explored whether the intervention of programming robots had a positive effect on girls' interest and self-efficacy in computer science and engineering versus young girls in a control group. In this study, researchers found that the STEM-gender stereotype that boys are better at robotics than girls was held by six-year-olds of both genders. However, the young girls who participated in the robot programming intervention demonstrated a significantly higher technology motivation versus those in the control group. Master et al. (2017), drew the conclusion that young children's gender differences in technology are flexible and influenced by access to and the impact of targeted experiences.

In Australia, educators worked to address this by conducting a two-year evaluation of a STEM initiative called *Little Scientists*, an educational curriculum designed to foster young children's interest in STEM through hands-on experiments and inquiry-based learning (MacDonald et al., 2019). The qualitative evidence reported demonstrated that children who participated in the Little Scientists program showed growing interest and confidence in STEM learning experiences (MacDonald et al., 2019).For slightly older children who are in

Piaget's formal operations stage, which has been compared the scientific method (Miller, 2011), children create a hypothesis about a present or potential event and then test out their hypothesis. The result of their hypothesis is not the most significant finding, but rather, the problem-solving process. STEM/STEAM offers students the opportunity to integrate mathematical problem-solving principles into solutions through art and design (Thuneberg et al., 2017). The incorporation of STEAM allows students who may not feel as well-versed in mathematical principles the chance to approach learning in a different way. In a study conducted in Sweden, young adolescents ages 12-13 had the opportunity to visit a mathematics exhibit with hands-on elements including building/designing. Researchers were specifically interested in whether taking part in the interactive math exhibit influenced the students' attitudes towards math and science and the perceived efficacy of their learning. It was found that the process of building and creating was an emotive one, leading to the lowest achieving students in a classroom setting expressing their interest and enjoyment of math and science subjects. Researchers suggest that the integration of art in STEM principles may lead to stronger positive emotions towards the subjects being learned, which could allow for deeper learning and higher rates of retention (Thuneberg et al., 2017).

The Role of the Library in STEM/STEAM Trends

As a longstanding partner in education, combined with the demonstrated importance of STEM/STEAM education, libraries are continuing to adapt their

services and resources to meet this demand. The Aspen Institute (Garmer, 2014) highlighted the importance of providing STEM/STEAM programming and learning opportunities for intergenerational communities. There is evidence, through library publications, professional membership, and increased library programming, that libraries are working to meet this need.

Various publications geared towards library paraprofessionals and librarians have been released in the past few years, demonstrating the continued efforts of libraries to incorporate STEM/STEAM into their programming. An example of this kind of publication comes from the Young Adult Library Services Association (YALSA). YALSA was an early adopter of STEM offerings within library programs, as the association felt that young adult services staff were uniquely poised to de-mystify STEM for their program participants. In 2013 YALSA released a STEAM Programming Toolkit, with the aim to provide library workers with accessible program curriculum. Offerings such as these toolkits and various library publications highlight the intent and interest of libraries to offer these valuable programs.

Another indicator of increased library activity related to STEM/STEAM is membership in organizations devoted to STEM/STEAM. Over the last decade, a variety of partnerships have sprung up between public libraries and education stakeholders who value and understand the role played by public libraries in informal education. One such organization is the Science-Technology Activities and Resources Library Education Network (STAR Net), which describes itself as,

“a community of library and STEM professionals that work together to strengthen STEAM learning in public libraries nationwide.” (STAR Net, 2020). STAR Net membership has grown dramatically over the last few years. The 2018 project impact statements reported over 3,900 professional librarians are part of their network and that 125,000 individuals had participated in STAR Net sponsored/supported programs in public libraries (STAR Net, 2018 as quoted. in Small, 2018). As of May 2020, STAR Net project impact statements report a 50% increase in librarians in their network, now boasting an impressive network of 8,000, and climbing, professional librarians. Further, the reach of STAR NET sponsored/supported programs within public libraries has extended their reach to over 300,000 individuals (STAR Net, 2020).

Finally, within the ALA and other ALA sponsored organizations, STEM/STEAM programming is on the rise, according to IMLS (2019). Utilizing data from the 2016 annual survey of public libraries, IMLS found that total public library program offerings increased nationwide by over 500,000 programs, in comparison with the number of programs offered in 2015. Based upon the reports of 34% of libraries offering STEAM programs during the 2014 Digital Inclusion survey, it can be surmised that at least a third of the new programs (roughly 166,500 or more) offered in 2016 could have STEAM elements. However, these numbers could be far greater, as STEAM gains traction in the library world. For example, in an article that appeared in the School Library Journal in 2013, a well-respected library publication, Amy Koester, a children’s

librarian, highlighted the increase in STEM/STEAM programming at libraries around the country, including incremental STEAM additions to storytimes at the Free Library of Philadelphia, such as plant science and balance. Other examples include providing “Makerspaces” where communities have the opportunity to access and use new technologies such as 3-D printers, robots, early coding tools, tablets and computers with advance design apps, digital illustrating apps, and more; as well as providing circulating science kits that families or educators can check out, full of materials, curriculum, and activity suggestions (Rodgers, 2018, Snelling, 2019). In 2018, the Wilson County Public Library in North Carolina, upon receiving a generous grant from the Library Services and Technology Act (LSTA), created a space within their library to focus on STEAM activities and began offering weekly STEAM programs. Thus far, marshmallow engineering, Legos, and other build challenges have proved popular, with library staff citing the appeal of open-ended imaginative play as a huge draw for children and families (Wilson, 2018).

Despite increasing interest in STEM/STEAM, as well as actual programming, most libraries still struggle with turning their interest in STEM/STEAM into actual programming. How do library workers – who may not have a background in teaching – create valuable programming that will offer their patrons a positive STEAM experience? This conundrum is highlighted by findings from a recent STAR Net survey, reported by Shtivelband et al., (2017) where 91% of the 717 libraries surveyed were extremely interested in offering STEM

programming; however only 69% felt prepared to offer STEM programs to their patrons. The interest in providing STEM/STEAM programming is clearly there. Yet, successful implementation needs more than interest. Building a capacity for STEM/STEAM offering at the library requires support; both financial and educational. One such source of support is grants designed to support the provision of innovative library services, including STEM/STEAM programming. This type of funding allows libraries to develop, refine, and test STEM/STEAM programming that can then be offered on a more permanent basis to library patrons, particularly children and families.

Summary and Purpose of Project

The purpose of this project is to demonstrate how one library system used grant funding to support the further development and provision of STEAM programming at two of its library locations. As STEM/STEAM programming continues to grow within libraries to meet the out-of-school educational needs of children and families, the ability to provide access to more advanced challenges, and occasionally, more sophisticated materials depend on funding and support. To this end, many libraries, including the one featured in this project, seek funding support from the Library Services and Technology Act, and provided by the Institute for Museum and Library Services. This funding became available in 2012 and supports various library improvements including literacy access, 21st

Century skills, 22nd Century tools, increasing digital access, creating information connections, community connections, and access for all.

The library in question received one of these LSTA grants with the goal of expanding 21st Century Skills. Specifically this goal focuses on, according to the California State Library, creating programs that foster lifelong learning, developing programs and support systems that provide access and education to all types of literacy required to be successful in the 21st century, developing programs and systems to provide access to skills for workforce success, and providing training and staff development to adequately equip library staff to serve the public in acquiring these skills. Based on a previous community needs assessment of city residents that outlined the desire for interactive "museum-like" early learning experiences, this library decided to focus their efforts on meeting their goal of 21st Century Skills by addressing their communities' desire for learning experiences, along with bolstering staff capacity to provide appropriate STEAM programming. While this library offered a robust line-up of programs for families prior to receiving this grant, there were few offerings specific to STEM/STEAM learning for young children.

Upon receipt of the LSTA grant, the library worked to refine a previously developed STEM program to include STEAM elements. This program, the "STEAM Petting Zoo," was based upon a previous pilot program the library offered, the "STEM Petting Zoo," which functioned in an open station format, allowing attendees to circulate through different activity stations and experiences.

As a STEM program, the content was primarily focused on bringing new technologies to the community through robotics, coding, and STEM applications on iPads. While this program was wildly popular, it was offered only as a pilot. In the previously conducted community needs' assessment mentioned in the previous paragraph, this program was specifically called out as an area that residents wanted to see grow. Additionally, as an attentive partner-in-education, the library was inspired by the rise of interest in STEAM within elementary schools to expand their offerings and incorporate STEAM elements, while simultaneously making program execution more approachable to library staff members.

To explore the efficacy of the libraries' revision to the STEM Petting Zoo pilot program and the community's perception of the library as a partner in education, the following program evaluation questions will be explored:

1. Do parents perceive a positive reaction of satisfaction and skill building from their children in response to the materials provided?
2. Do parents consider the pilot program and the library as an educational resource?
3. Do parents consider the pilot program as valuable and something they would return to?

CHAPTER TWO

METHODS

Overview

An introductory STEAM workshop was offered to children ages 7-14 and their accompanying adult caregivers at a library location. A variety of STEAM activities were offered in an open station format to gauge community interest in STEAM library programming and the efficacy of programs for the age range. Program attendees were surveyed using a Likert scale survey and offered the chance to provide additional comments at the end of the program to determine community perception of library programs, interest in STEAM offerings, and efficacy of the program.

Preliminary Recruitment via Advertising

As a free library program, the workshop, “STEAM Petting Zoo” was made available to all during a special week of grant-funded STEAM programs during spring of 2017. Advertising in print, on social media, and displays within the library where the programs were offered began in January 2017. Verbal advertising to library patrons also took place from January 2017 until the time the program occurred, at service desks within the library and at community outreach events. The initial print advertising read:

> Welcome to the STEAM Petting Zoo where Science, Technology, Engineering, Art and Math come to life. There will be a variety of activities

to choose from, whether its technology based or not, the concepts remain the same. Robotics, pulleys, and other hands-on activities await. This walk-in program is for children ages 7-14 with their parent/caregiver. (See Attachment 1 - Print Advertising)

Program Design

Upon the receipt of the grant, library staff collaborated to explore trends in library programming and possible materials to support their STEAM program goals. Library staff were provided with time away from their regular duties to familiarize themselves with the Next Generation Science Standards, peruse suggested age-appropriate activities and research materials, view a variety of trainings on usage of the acquired STEAM items and programs, and research implementation of inquiry-based learning approaches. Following the initial stages of training and exploration, staff collaborated on program structure and implementation plans.

The program was created with open exploration of STEAM materials in mind. Following the format of a previous library program “STEM Petting Zoo,” this workshop aimed to provide school-aged children from 7-14 with STEAM experiences. Based upon previous programs, this workshop was developed to offer activity stations with STEAM items including an iPad utilizing the Osmo device and accompanying app, basic coding devices, vexIQ robots with a battle stage, and a variety of building provocations with common materials. The

workshop was set up in a large open space and participants were encouraged to explore each activity station over the course of ninety minutes.

The workshop itself was offered to the community twice over the course of the week of special programs. The library system offered the programs at two different library locations. Program A took place on a Monday morning immediately after the library opened. Program B took place on a Friday afternoon.

Workshop Stations and Materials

1. iPad with Osmo Station

Description: The Osmo device is comprised of a tablet base and a reflector piece that fits over the device camera. The reflector piece serves as a scanner, which communicates the image onto the application and reflects it on the screen.

Station Set-up and Instruction: The Osmo device and accompanying application was utilized on two iPad stations. Each iPad was set up with a virtual tangram puzzle challenge displayed on the screen, with accompanying physical tangram puzzle pieces available for the participant to work with. Various puzzle combinations were shown on the screen and participants were encouraged to replicate the puzzle combination with the physical pieces.

Staff in the area provided a basic introduction to the device, such as “Here at the iPad station, we are using Osmo to help us make tangram puzzles! Look at the screen and you will see a puzzle combination. Try it out with the tangram pieces on the table. Osmo will help you see your creation on the screen!”

2. “Code and Go” Robot Mouse with Maze Building

Description: The Code and Go Mouse is an activity set comprised of a robotic mouse, maze grids that can be built into various mazes, maze walls, tunnel pieces, a toy piece of cheese, and coding cards with directional instructions.

Station Set-up and Instruction: A prebuilt maze with walls and tunnels was preassembled. The mouse and coding cards were available for children to manipulate as they chose.

Staff in the area provided a basic introduction to the coding device such as, “This is Colby, the coding mouse! You can give him directions by using these cards to help him find the cheese.” Children were encouraged to test out the materials, with staff taking the role of an observer after introducing the materials.

3. Building Station

Description: The building station consisted of bins of K’NEX rods and connectors.

Station Set-up and Instruction: The building station was laid out in an open space at both programs. Bins containing K’NEX rods and connectors were placed on the ground to encourage large builds.

There were no staff stationed at the building area to encourage children’s free expression with building provocations. At both programs, staff monitored from a distance and stepped in if the build became unsafe or if a participant requested help finding an item, etc.

4. LEGO WeDo Robot Coding with Scratch

Description: The robot coding station consisted of two tabletop stations set up with four LEGO WeDo kits and four Chromebook computers.

Station Set-up and Instructions: The robot coding station was laid out as a small tabletop station in both programs. Bins holding each LEGO WeDo kits were placed on tables and each kit was paired with an accompanying Chromebook. At each program there were a minimum of two staff stationed in the area to provide direct instruction for use of the kits and to assist with any needs. Floating program staff also joined in if the area became crowded. Attendees were met with a general welcome, “Welcome to the Robot Coding station! Do you know what coding is? Have you ever coded with Legos?” Interactions and instruction were tailored to the individual needs and interests of the attendees as they interacted with the materials.

5. VexIQ Robot Battle Station

Description: The robot battle station consisted of a “battle” area comprised of VexIQ Challenge Field perimeter and tiles, tables with completed robots and controllers, and tables with robots in various states of assembly with parts in bins.

Station Set-Up and Instruction: The robot battle station was laid out in an open space at both programs, allowing for attendees to circle the Challenge Field.

A minimum of three staff were stationed in the area to provide direct instruction and modeling of the controller usage, moderate the Challenge Field, and assist

attendees in enhancing the robot builds. Staff in the area provided a brief welcome, “Welcome to the Robot Battle Station! Would you like to test out a robot?” and tailored their interactions to the expressed interest of the attendees.

Participants

Program attendees were recruited through advertising on social media, the library’s website, and in flyers/posters displayed in the library. All caregivers were encouraged to complete an anonymous paper survey at the end of the program. The only criteria for participation in the surveys was program attendance with a child; however, participation in the surveys was not a required condition of attendance.

During the program library staff conducted a general count of participants for attendance; however, no identifying details such as number of adult participants vs. number of child participants, number of family units, etc. was recorded. Attendance was 75, including both children and accompanying caregivers. A total of 27 caregiver questionnaires were submitted, a participation rate of 36% among attendees. No specific information was gathered regarding the number of children who attended per adult attendee or any further information that may identify the families in attendance.

Demographics

No demographic information was collected from survey respondents during the programs. However, it is assumed that attendees in the program came from the surrounding city or within reasonable driving distance. The mid-sized

city in which the programs were held is comprised of residents with a mid-to-high income range who generally hold a high school education or above.

Procedure

Participants were welcomed to the library program by staff at the entrance to the workshop, which was offered on two different days at two different library locations. Library staff facilitating each of the Programs differed across locations. At Program A the participants were met at the bottom of a staircase and directed upstairs to an open programming space with a variety of stations set up and met by an additional staff member. At Program B participants were met at the entrance to a programming room by one staff member. As they entered the program space, one staff member provided a brief description of the open-ended exploration opportunities. Each one of the activity stations was facilitated by library staff who provided more direct instruction for the specific activity. Children and caregivers were encouraged to explore each activity for as long as they liked. At the end of the workshop, caregivers were asked to complete a short paper survey, which was distributed by staff on a clipboard with a writing instrument. Completed surveys were returned to staff members at the exit. Estimated attendance was gathered by staff at the entrance, using counters, to ensure staying within fire code capacity of the space and for general statistics for grant purposes.

Participants in these programs participated freely of their own will. Programs were offered free of change and were available on a first-come, first-

serve basis. Each adult participant was offered the opportunity to complete an optional survey at the end of the program. Library staff shared a brief statement to participants regarding the surveys:

> We would love it if you could fill out a feedback survey for us. These programs are grant funded and your feedback helps us create our grant report. We may also use this information to help inform the programs we offer in the future and to share with our library stakeholders. Your participation is completely voluntary, and results are anonymous.

Surveys, clipboards, and pens were made available at a table by the programming room exit. Participants were invited to place completed surveys in a collection bin on the same table. At each program, staff mentioned the surveys to participants as they entered the programs and as they were leaving. No program attendees were required to complete a survey to participate in the library program.

Following the end of the program, completed surveys were processed in order below:

- Completed surveys removed from collection bin and placed in sealed envelope. At this time data across the two Programs (A and B) was collapsed, rendering site comparisons impossible.
- Envelope of surveys delivered via staff delivery to the staff member responsible for grant data.

- Surveys were opened and responses manually entered in digital spreadsheets available to library staff only.
- Physical surveys stored in locked cabinet within library staff offices.
- Following a period of two years, the physical surveys were shredded and discarded. The digital spreadsheets remain accessible only to library staff, on a private server maintained by the city.

The deidentified collective data gathered for the entire grant that these programs were part of was presented by a group of the library staff at a statewide library conference in 2017. Specific program data was not shared. Summaries of the deidentified collective data has also been shared with library stakeholders at private fundraising events for the library, the city council, and members of the city management team. No statements to the general public have been made regarding the collective data.

The data presented within this project was not, nor will be shared further in any forum in the future.

Measure

A simple survey was developed by library staff and provided to participants, consisting of a six item Likert scale with an additional comment field. The purpose of the survey was to gauge community interest in the topics offered, community perception of the library, and efficacy of programming. The comment field was included to offer participants the chance to share further feedback to staff. (See Attachment 2 – Caregiver Survey)

The six item Likert scale offered the following range of options to respond to each of the seven questions. Responses were scored as follows:

1 = Strongly Disagree

2 = Disagree

3 = Neither Agree nor Disagree

4 = Agree

5 = Strongly Agree

CHAPTER THREE

RESULTS

Survey Responses

Adult program attendees were offered the opportunity to share feedback via brief surveys (See Attachment 2 – Caregiver Survey). The survey consisted of six statements rated on a five-item Likert scale; responses were scored as follows:

1 = Strongly Disagree

2 = Disagree

3 = Neither Agree nor Disagree

4 = Agree

5 = Strongly Agree

Participants were also provided with an area for open-ended comments and suggestions.

Following the two pilot programs, a total of 27 caregiver surveys were submitted, constituting a participation rate of 36% among attendees (total program attendance = 75). No specific information was gathered regarding the number of children who attended per adult attendee or any further information that may identify the families in attendance.

Both the survey and comment responses were entered into an Excel spreadsheet. See the compiled responses below in Table 1 – Likert Scale Responses and Table 2 – All Survey Comments received.

STEAM Petting Zoo Caregiver Responses								
Question	Number of responses	Strongly Disagree (1)	Disagree (2)	Neither agree nor disagree (3)	Agree (4)	Strongly Agree (5)	Mean Response Score	Summary
I think my child enjoyed the STEAM Petting Zoo.	27	0	1	1	3	22	4.70	93% agree/strongly agree
My child demonstrated interested in the subject matter (pulleys, robotics, etc.)	27	0	0	0	6	21	4.78	100% agree/strongly agree
My child learned something about STEAM concepts through experiencing hands-on activities.	27	0	0	1	3	23	4.78	96% agree/strongly agree
My child displayed skills I have not seen before (working a pulley, entering commands for robots, etc.)	27	1	0	6	7	13	4.15	74 % agree/strongly agree
I consider the Library an educational resource for my family.	27	1	0	0	3	23	4.74	96% agree/strongly agree
I think my child would like to come back to further programs like this one.	27	1	0	1	2	23	4.70	93% agree/ strongly agree

Table 1. Likert Scale Responses

Generally, participants strongly agreed with the questions asked (93-100% provided an answer of 5 or strongly agree). These results indicate that participants found the program to provide an enjoyable, educational experience for their children and that they see the library as an educational resource that they would like to utilize again in the future. The exception to this trend was

Statement 4, “My child displayed skills I have not seen before (working a pulley, entering commands for a robot, etc.” This statement was included to further gauge adult caregivers’ perception of the program and their perceived value of the program as a concrete opportunity for their children to acquire new STEAM skills. The mean response for Statement 4 was a 4.15, which may be rounded down to a response of 4 or “Agree.” with 74% of respondents selecting “Agree” or “Strongly Agree.” In contrast, 22% of respondents selected “Neither agree nor disagree” while 4% (or one sole respondent) selected “Strongly Disagree.”

In addition to showing the reaction of participants to the program overall, responses to each of the statements in Table 1 speak to the specific program evaluation questions identified earlier in this paper. Participant responses to each of the questions asked on the survey will now be applied to these three program evaluation questions; 1) Do parents perceive a positive reaction of satisfaction and skill building from their children in response to the materials provided?, 2) Do parents consider the pilot program and the library as an educational resource?, and 3) Do parents consider the pilot program as valuable and something they would return to?

Program evaluation question 1, “Do parents perceive a positive reaction of satisfaction and skill building from their children in response to the materials provided?” Statements 1-4 addressed this evaluation question. In Statement 1, the results speak to whether the program was perceived as an enjoyable experience for the child attendees. In Statement 2, the results help

gauge whether the program was adequately designed to meet the interest of the child participants. Statements 3-4 both speak to STEM/STEAM learning and the possibility of acquiring new skills. Despite the lower overall response to Statement 4, as noted earlier, and which will be further discussed later in this paper, the responses to program evaluation question 1 were overall positive. On average, 90% of program attendees responded “Agree” or “Strongly Agree” to Statements 1-4.

Program evaluation question 2, “Do parents consider the pilot program and the library as an educational resource?” Statements 3-5 addressed this evaluation question. Statement 3 highlights caregivers’ perception of children’s learning occurring with the program. Statement 4 is similar in that it speaks to the potential acquisition of new STEAM skills by the child participant. Therefore, if adults responded positively that their child(ren) learned something through program participation or demonstrated new skills, it can be inferred they may consider the program an educational resource. Additionally, Statement 5, which states outright that participants consider the Library as an educational resource for their family, is used to inform this evaluation question. On average, 89% of program attendees answered “Agree” or “Strongly Agree” to Statements 3-5.

Program evaluation question 3, “Do parents consider the pilot program as valuable and something they would return to?” Statements 4-6 address this evaluation question. It can be inferred that those who responded

positively to the Statement 4 regarding the acquisition of skills, and Statement 5, viewing the Library as an educational resource, would consider this program valuable. Finally, Statement 6 also informs this question, as it directly addresses whether adult caregivers consider this program as something they would return to with their child(ren). On average, 88% of program attendees answered “Agree” or “Strongly Agree” to Statements 4-6.

Comments

The open-ended comment field garnered 15 comments containing positive and constructive feedback. Comments were entered verbatim into the library’s Excel sheet of results. Comments are presented verbatim with the exception of those that included identifying respondent or program details.

All Comments Received
Liked the variety of resources provided for the children!
Daughter was slightly disappointed, expecting an actual petting zoo…but quickly got over it.
More activities for the children and enjoy the programs
Thank you for giving a great time.
Please provide left-handed scissors!
Really fun! Instructors are very helpful & enthusiastic!
Because there was such amazing different stations, I think a little longer time will be better.
This is a great educational program, hope it will expand to more age groups.
Perfect for beginners so they discover. I would have liked it if there was a timer for each station (longer for some). Some kids spent more time on some and some kids didn't get a chance to try them.
My children really enjoyed this program. They learned a lot today.
We are glad that we attended this program today at the brand-new STEM floor. I hope the library can offer this kind of program more often. Summer too!
The program for kids is fabulous. I was wondering next time you can have more computers for more motion sensors lego. We all love the activities + had a good learning sessions for the kids.
We are glad that we attended this program today at the brand-new STEM floor. I hope the library can offer this kind of program more often. Summer too!
We LOVE our XX Library and all the awesome programs & experiences it provides. Keep find new & awesome things for the kiddos! But, maybe more A/C next time? :)
This was a great program and I look forward to more. My son wasn't interested in STEM until today. Thank you!

Table 2. All Survey Comments Received

The open-ended comment field was included in the program evaluation survey with the hope that participants would share constructive feedback that could be used to inform future programs, as well as speak to each program evaluation question. The open-ended comment responses received were also used to gather a general understanding of participant perception of the program.

For example, the comment, "*This is a great educational program, hope it will expand to more age groups*," spoke to program evaluation questions 2 and 3, as it indicated that 1) adult attendee considered the program an educational resource and 2) attendees would be interested in attending similar programs in the future. It also indicated that a wider age range for future programs may be successful. Further, comments received such as, "*Please provide left-handed scissors!*" and "*…I was wondering next time you can have more computers for more motion sensors lego…"* provided suggestions for tweaks to the program design to better serve participants. Finally, short anecdotal responses such as, "*We LOVE our XX Library and all the awesome programs & experiences it provides. Keep find new & awesome things for the kiddos! But, maybe more A/C next time? :)"* could be shared in final grant reports and with stakeholders to demonstrate the positive community perception of the Library and its' program offerings.

CHAPTER FOUR

DISCUSSION

Libraries are unique establishments within American culture, and they impact their communities in many positive ways. The responsive services offered by libraries to meet the need for technology access, reading materials, lifelong learning opportunities, and more, leads to increased community engagement (Miller et al., 2013, Digital Inclusion Survey, 2017, Lopez et al., 2016). One segment of the community that is positively impacted by the library and the services that it provides is families. Libraries represent an important component of family systems and both impact families directly (through the microsystem) and through connections with other important community services (the mesosystem), such as the K-12 education system.

Libraries are attentive to the developing needs of communities and take their role as a partner in out-of-school education seriously. As educational trends have shifted to an emphasis on STEM and STEAM learning, libraries have worked to alter their services. In 2016 the Obama administration championed STEM education in a variety of ways including further funding and a commitment to supporting collaborative, experiential family engagement activities that highlighted STEM learning for young children (“Fact Sheet”, 2016). As community hubs with experience in multi-generational offerings, public libraries were poised to act as a partner in meeting these goals.

In the pilot program presented, a public library created an interactive STEAM workshop after receiving grant funds geared towards the IMLS and CSL goal of 21st century skills. This library was no stranger to gathering community feedback, as they had previously conducted community needs assessments which highlighted a desire for "museum-like experiences" within their community. Such community-based participatory research (CBPR) is beneficial for communities, as it focuses upon partnerships between research entities and community stakeholders while working towards overall engagement and societal transformation (Wallerstein & Duran, 2016). Although CBPR is not frequently formally named within library research, public libraries are essentially facilitators of CBPR. However, many individual programs are conducted with a lack of empirical data gathered regarding the reception and impact of content.

The results of the pilot program evaluation demonstrate that 96% of survey respondents consider the library as an educational resource. Further, the comments garnered, including “This is a great educational program,” and “Perfect for beginners so they discover,” demonstrate the community’s interest in the library’s offerings.

Overall, the responses gathered were positive, with most respondents either agreeing or strongly agreeing with the statements. Statements 1-3 and 5-6 all received responses of “Agree” or “Strongly agree” between 93% to 100% of the time. The positive response of 93% “Agree” or “Strongly Agree” for Statement 1, “I think my child enjoyed the STEAM Petting Zoo,” may be indicative of the

overall need, and subsequent appreciation for the availability of intergenerational STEAM programming referenced by Garmer (2014). The need for such intergenerational learning opportunities has been highlighted by past presidential administrations ("Fact Sheet," 2016). Further, the 100% positive response of either "Agree" or "Strongly Agree" to Statement 2, regarding interest in the program subject matter, demonstrates the community focus upon STEAM offerings. While there is limited program specific data available on library STEM/STEAM programs, those that have been shared publicly report overwhelmingly positive community reception (Rodgers, 2018, Snelling, 2019, Wilson, 2018).

For the library in question, a key goal of these pilot programs was to further establish the Library as an out-of-school partner in education. Statements 3 and 5 provided affirmation that this library is on the right track, with 96% of respondents answering "Agree" or "Strongly Agree" to these statements. Lifelong learning is highlighted in the Declaration for the Right to Libraries (2013) and as an institution that serves intergenerational communities, it is important for the Library to be acknowledged as a contributing educational resource by its' users.

While the results received from the survey statements were overall very positive, it must be noted that Statement 4, "My child displayed skills I have not seen before (working a pulley, entering commands for robots, etc.)" received varied responses, with only 74% of respondents answering "Agree"/ "Strongly agree" and 26% responding either "Neither agree or disagree" or "Disagree." This

variation in results could be attributed to the potential socio-economic status of program attendees. Responses to Statement 4 may be indicative of a variety of circumstances, which may have occurred within the program or externally : 1) a lack of observable novel skills displayed by child participants 2) a high level of child participant familiarity with the offered materials or 3) a lack of caregiver or parental attention to program activities, among other options. As previously stated, the pilot programs took place in a mid-sized city with a mid-to-high average household income. Summarized findings from the Internet and American Life Project state that parents in household incomes under $50,000 are more likely than those in higher income brackets to utilize digital technology resources (Miller et al., 2013); therefore, it can be gathered that perhaps the children who were in attendance in these programs came from the surrounding area with mid-to-high incomes and may have already had access to some of the STEM/STEAM items or similar materials offered within the pilot programs.

Within the results, there was one outlier who responded "Strongly Disagree" to questions 3-6 and did not leave any further comments in the open-ended response field. As no identifying data was collected, there is no way to ascertain if these responses were a misunderstanding of the scale, dissatisfaction with the program, or otherwise.

The open-ended comment field also garnered positive and constructive feedback. Most comments were praise, such as “*Thank you for giving a great time*,” and “*My child really enjoyed the program. They learned a lot today*.” These

examples of positive program reception are useful to the Library in providing concrete examples to possible stakeholders, as well as in grant reports. The comments that contained specific constructive feedback such as, "*Please provide left-handed scissors!*" and *"…I think a little longer time will be better*," may help to inform future programs' inclusivity and program design.

Limitations

A significant limitation of this project was the lack of consistency between Program A and Program B. Due to space constraints, these programs were offered within different physical environments, which led to differences in the welcome experience and overall program.

In Program A, participants attended the program on the second floor of the library location which was not yet open to the public. To control capacity and deter non-program attendees, staff were stationed at the foot of the stairs to provide an initial check-in and program participants received a full program introduction at the top of the stairs by another staff member. In contrast, Program B participants were met at the programming room door by a single staff who provided a program introduction. This varying welcome experience may have led to some confusion for program attendees and perhaps, some dissatisfaction with the program. Due to differences in physical space capacity, Program B was offered to a smaller group of participants than Program A, which may have led to more individualized attention by staff program facilitators for participants in Program B. This is potentially a large difference between programs and could

likely have impacted adult caregivers' perception of the educational value of the program indicated in survey Statements 3 and 4. However, the larger physical space in Program A may have made it more difficult for adults to observe their children closely and could have contributed to lower scoring on these survey statements.

Additionally, data from both programs was combined, with no opportunity for differentiation within the data spreadsheet. This lack of differentiation makes it impossible to distinguish if scores varied by location. If survey responses had been maintained separately for each program, more inferences could be made regarding the difference in program reception, as previously discussed. A further overall limitation is the lack of demographic information gathered. Although some conclusions can be drawn regarding participant demographics, the general lack of any demographic information limits the utility of the results. An inclusion of even basic habits of the participants, such as how many library programs they have attended, how often they frequent the library, or how long they have been library patrons could have provided additional information to help frame the participants' responses and build greater understanding of the group of participants and their perceptions of the program efficacy. While the questions asked did gauge participants general perception of whether children enjoyed the program, further questions regarding the specific program activities could provide a greater understanding of participants' program perception. Additionally, the survey failed to provide a sense of the participants familiarity with the Library's

programming. To determine if the attendees were Library regulars, drop-ins, etc. further questions regarding familiarity with library programs and frequency of program attendance should be included. Overall, an enhanced caregiver survey with more robust questions would provide more compelling responses to address the program evaluation questions.

Future Directions

While libraries are working to establish themselves as an out-of-school partner in education, there is limited research and documentation of public libraries' formally partnering with the K-12 education system to provide educational offerings that are aligned with school learning standards. This may be due in part to a disconnect between public library services, which are often city or county funded, and local schools. Additionally, as many K-12 institutions have embedded school librarians or library media technicians ("The Condition of U.S. Libraries: Trends," 2009), teachers and school administrators may overlook the public library as a more formal partner in education and a viable resource for enhancing curriculum.

For example, a collaboration between the Hartford Public Library and local schools wherein a small publicly run library was nested within an elementary school to offer services during after school hours and access to materials for all students was discussed in Miller (2019), however, this collaboration was primarily based upon after school care and access and did not address a partnership within STEM/STEAM education. Additional limited research has been gathered in

anecdotal and self-report format from library staff, with limited responses from school partners, including recent research conducted by the Joan Ganz Cooney Center, in which only 29% of library professionals surveyed reported aligning library materials and offerings with school curricula. However, a higher number (62%) of library professionals surveyed reported informally encouraging students to connect their personal interests to their schooling (Takeuchi & Sobel, 2020). While this research is encouraging and indicates a move in the direction of gathering compelling data that provides evidence of the public library as a partner in education, more powerful evidence is needed. Further research within the fields of library science and K-12 education would benefit from empirical support of the outcomes of such partnerships.

In future programs, for the sake of consistency, program evaluations should be maintained separately by location. Further, the Library should maintain either precise directions for staff behaviors, if they intend for the program be an open-exploration experience, or comprehensive records of the station staffing. By doing so, library staff may be able to note a difference in survey responses, which may be influenced by the staff facilitating at each location or specific station. In addition, the inclusion of questions to judge a child's baseline level of comfort with STEM/STEAM may provide a greater depth of knowledge. If programs were offered more extensively in the future, this information could serve to inform the various levels of difficulty of STEM/STEAM programming offered, as well as the overall content and program design. The STEAM Petting

Zoo was geared towards child participants aged 7-14, which is a large age range and could also contain a wide spectrum of potential STEM/STEAM familiarity. It is recommended that future programs offered adjust their target age ranges to a smaller spectrum to align with NGSS goals or specific school curriculum. If so, it would be valuable to gain a baseline understanding of children's comfort with STEM/STEAM in a pretest/post-test environment. However, this level of data collection is somewhat unusual for library programs, unless they are long term offerings.

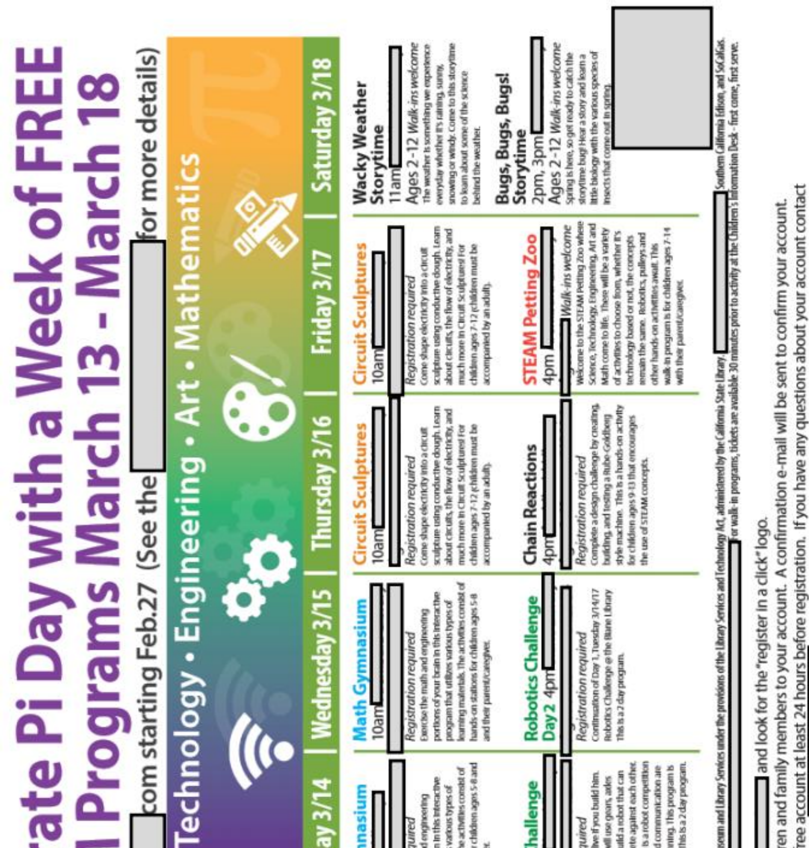
Conclusion

The present program evaluation provides data that supports the perception of the library as an out-of-school partner in STEM/STEAM education. This program evaluation demonstrated that the materials utilized in the library program were aligned with children's interests and these materials assisted in demonstrating STEM/STEAM concepts. Further, the library's goal of capturing participant feedback and positive perception of the library was successful. The responses garnered indicates that future library STEM/STEAM themed programs will likely be well received by the community. Finally, this program evaluation may assist in furthering the understanding of the unique and influential role that public libraries play in supporting the development of young families.

APPENDIX A

ADDITIONAL DOCUMENTS

Attachment 1 – Print Advertising



Attachment 2 – Caregiver Survey

Pilot Program Caregiver Survey

Pilot programs made possible by grant funding*
For more information please contact the

Pilot Program: **Date of Implementation:**

Thank you for your participation in this pilot program!

Please circle how much you agree or disagree with each of the following statements:

	Strongly Disagree	Disagree	Neither agree nor disagree	Agree	Strongly Agree
1. My child enjoyed the (program name)	1	2	3	4	5
2. My child demonstrated interest in the subject matter (pulleys, robotics, etc.)	1	2	3	4	5
3. My child learned something about STEAM concepts through experiencing hands-on activities.	1	2	3	4	5
4. My child displayed skills I have not seen before (working a pulley, entering commands for robots, etc.)	1	2	3	4	5
5. I consider the Library an educational resource for my family.	1	2	3	4	5
6. I think my child would like to come back to further programs like this one.	1	2	3	4	5

Please share with us any additional comments you have regarding today's pilot program:

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Developed by Gwyneth Fernandez.

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