Maker programs in preK-12 school libraries: identifying the drivers and consequences

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Maker programs in PreK-12 school libraries:

Identifying the drivers and consequences

by

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ABSTRACT

In 2005, Dale Dougherty and O’Reilly Media founded Make Magazine, and coined the term Makerspace, which is broadly defined as a community workspace where people come together to solve problems using materials and tools they might otherwise not have access to (Dougherty, 2012). Recently, schools have allocated funding and resources into creating and maintaining maker programs in classrooms and libraries. Despite the overwhelming discussion of making and makerspaces in library practitioner-oriented publications, there is little scholarly discussion of maker programs in PreK-12 school libraries. This research addresses that gap by examining makerspaces in libraries in PreK-12 public schools in New York State using an embedded case study approach. This study positions makerspaces as an innovation in school libraries and examines the drivers and consequences of implementation. Two qualitative data sets are used in this study: open ended responses from a survey of school librarians and transcripts of semi-structured interviews with school librarians and other school personnel where maker programs have been implemented in the library.

The analysis shows that there are two main drivers of maker program adoption – 1) the beliefs of school librarians, and 2) the visibility of maker programs in communication channels. The analysis shows five desirable consequences – 1) improved social emotional skills for students, 2) changing perceptions of school libraries, as well as 3) school and learning, 4) increased usage of the library, and 5) increased support for student learning through a) improved resource access and utilization, b) improved relationships with students, and c) increased collaboration with teachers. The analysis further identifies two unanticipated, but desirable consequences – 1) a change in attitudes and beliefs of school librarians and other educators, and 2) school librarians positioned as change agents. The analysis identifies three main undesirable consequences – 1)
increased workload for school librarians and others in the school, 2) changing financial costs for the school and librarian, and 3) increased risk. These consequences are related to a) obtaining, managing, and maintaining materials and equipment, b) designing and implementing activities, c) renovating or modifying the library space, and d) training.

The results indicate that maker programs have far reaching consequences, and the potential to affect not only students, but also librarians, libraries, schools, and the wider community. The results of this study have several important implications for future research, as well as for practitioners.

*Keywords*: makerspace, maker program, school library, school librarian, school media specialist, innovation adoption, adopter, drivers, consequences
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Special thanks to everyone who participated in this study. I can’t name names, but you know who you are!
DEDICATION

“I just wanted to say thank you. Thank you for creating the makerspace. Thank you for providing this opportunity for me to realize that I am smart, that I can be good at something.” (Emily M., personal communication, June 15, 2017)

“If an individual is found to possess the requisite skills for expertise, but is never exposed to a potential talent domain, that person’s range of potential development outcomes will be unnecessarily limited” (Papierno et al., 2005, p. 328).

This dissertation is dedicated to all of those who showed me I could - thank you for believing in me and pushing me to believe in myself. Thank you for not letting me give up.

To my child Anastasia (Sam) Mersand. Thank you for being you – always and forever. Never be afraid to be who you are. Don’t believe anyone who says you can’t. To my students – past, present, and future. Without you, this research would not exist. I hope that in some way I have had a positive impact on all of you. To my family and friends, without whom I never would have made it this far. To my late father Bradley Hosier Jr., who introduced me at a very young age to the joys of problem solving through hands on creativity. To my late mother Diane E. Hosier, who taught me that no matter what stands in your way, if you want something bad enough, you fight for it. To my sister Rebecca (Becki) Kipling, who placed me in a room full of her colleagues with PhD after their names and made me believe I belonged. To my brother Sean Hosier, for showing me that life, no matter how difficult, can also be fun. To Melanie Granger, who told me I was insane, but continued to support me every step of the way and read every draft
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Chapter 1: Introduction

Making and makerspaces are heralded as a way to democratize access to ideas and tools that will enable people to become producers, rather than consumers, and allow everyone an opportunity to create and learn (Gershenfeld, 2010; Harron & Hughes, 2018; Martinez & Stager, 2013, 2019). It has been proposed that “making” holds the key to revolutionizing education and society (Dougherty & Conrad, 2016). Proponents of makerspaces believe that makerspaces have a positive effect on physical, social, emotional, and academic outcomes (Dougherty & Conrad, 2016; Martinez & Stager, 2013). Museums, community spaces, universities, academic, and public libraries, as well as PreK-12 schools, classrooms, and libraries, are creating makerspaces at a rapid pace. In particular, there is overwhelming attention given to maker programs in library and school library practitioner publications and discussions (Daley & Child, 2015; Fontichiaro, 2016; Fourie & Meyer, 2015; Graves, 2014; Loertscher et al., 2013; Seymour, 2015; Smay & Walker, 2015). Yet, “[t]he lack of data around makerspaces can present problems for administrators and librarians when justifying the need for the spaces in their schools or when determining the scope of their makerspace projects” (Bell, 2015, p. 10). As making and makerspaces spread throughout the world, researchers are beginning to explore what they are and the effects they may have. This study examines the drivers and consequences of adopting innovations in school libraries using the case of maker programs in PreK-12 public school libraries in New York State.

Rogers defines an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (2003, p. 475). Maker programs may be considered an innovation because they are a new practice that has the potential to change how school libraries operate. Maker programs may also be viewed as a collection of innovations: they are, on one
hand, a technology innovation as many makerspaces are equipped with technology like 3D printers, robots, and microcomputers; on the other hand, they are a pedagogical innovation in that they ask educators to rethink teaching and learning. When developed within a school library, maker programs can be a resource that is integrated throughout the school, therefore they have the potential to affect the entire school community.

Dale Dougherty (2012) describes a makerspace as a community workspace where people come together to solve problems using materials and tools they might not have access to otherwise. Martin (2015) provides a working definition of making as a “class of activities focused on designing, building, modifying, and/or repurposing material objects, for playful or useful ends, oriented towards making a ‘product’ of some sort that can be used, interacted with, or demonstrated” (p. 31). Bevan (2017) describes making as “a rapidly emerging form of educational practice that involves the design, construction, testing, and revision of a wide variety of objects, using high and low technologies, and integrating a range of disciplines including art, science, engineering, and mathematics” (abstract). Martinez and Stager (2019) explain “[m]aking is a stance that puts the learner at the center of the educational process and creates opportunities that students may never have encountered themselves” (p. 34). The first definition focuses on the outcome, the second on what making involves – the materials and disciplines, the third on the participants.

Sheridan, Halverson, and Litts (2014) define makerspaces as “informal sites for creative production in art, science, and engineering where people of all ages blend digital and physical technologies to explore ideas, learn technical skills, and create new products” (p.1). Oliver (2016) explains “[m]akerspaces take many forms but generally involve a physical space with shared resources to pursue technical projects of personal interest with the support of a maker
community.” Browder (2017) explains “[m]akerspaces have emerged as shared fabrication facilities, where makers of all types gather to invent, tinker, build, learn, and iterate using a range of manufacturing technologies.” Hira and Hynes (2018) define makerspaces as “environments where individuals use technologies to make physical artifacts within a community of fellow makers.” Although each of these definitions is inclusive of the space, participants, and outcomes, each of these definitions focus on the technologies.

According to Martinez & Stager (2019) “there is no list of required equipment that defines a makerspace” (p.4). Making involves a variety of activities including engineering, tinkering, circuitry, robotics, crafting, computer programming, woodworking, fiber artistry, and a host of others (Martin, 2015; Martinez & Stager, 2013, 2019). Makerspaces are places where participants may work together to create and co-create knowledge and physical or digital products. A making environment provides the potential for interdisciplinary connections, collaboration, creativity, innovation, and learning (Martinez & Stager, 2019). In a makerspace individuals and groups may be engaged in multiple activities occurring in the same space. They may also be engaged with components of different activities, and feedback from individuals and groups may cross-pollinate the projects (Gross & Do, 2009; Peppler & Bender, 2013; Sheridan et al., 2014).

Taking the above definitions of making and makerspaces into account, for the purpose of this study the following definitions will be used. A maker program is a broad term used to describe the presence of either a makerspace or maker activities. A makerspace will be defined as an area that provides materials and tools (high tech, low tech, or no tech) to encourage individuals or groups to make things, to create new knowledge, or to solve problems. Maker
activities will be defined as activities that allow participants to utilize tools and materials to make things, to create new knowledge, or to solve problems.

Previous research has explored maker programs in community spaces, workshops, PreK-12 schools, university programs, public libraries, academic libraries, museums, and hospitals. Although previous studies have included PreK-12 students, very few were set in PreK-12 schools. Similarly, while previous studies have examined public or academic library settings, no studies were set in school libraries.

Public school libraries are fundamentally different from other organizations that may create and maintain maker programs. First, public schools provide access for all students, while there is lack of consistency and equity in the youth who access makerspaces in museums, public libraries, and other community organizations. Although previous research has examined the consequences of maker programs and activities, it is possible the outcomes identified in previous studies are related to self-selection bias. Additionally, school libraries must operate within the curricular goals of the school building and district, and the services and resources provided often need to align with local, state, and national curriculum. Therefore, the reasons for adopting a maker program in a school library may be different than those of other organizations. As a result, the outcomes for students may be different.

Advocates of maker programs believe that maker activities have the potential to contribute to growth in skills in STEM (science, technology, engineering, and math). Much of the discussion about maker programs in schools and school libraries has centered around how they can improve STEM and STEAM (science, technology, engineering, arts, and math) outcomes (e.g. Baker & Alexander, 2018; Fourie & Meyer, 2015; Meyer, 2017; Bean et al., 2015; Bevan et al., 2015; Clapp & Jimenez, 2016; Martin, 2015). However, practitioner literature
also indicates that maker programs are being implemented in school libraries for other reasons, including to help students grieve for a lost classmate (Seymour, 2015), to be more inclusive of LGBTQ students (Moorefield-Lang & Kitzie, 2018), to support English Language Learners (Murph, 2018), to create new opportunities for graduation endorsements (Baker & Alexander, 2018), and to combine problem scoping during the design process with close reading (Blakemore, 2018). There have also been connections drawn between maker programs and inquiry learning, providing student leadership opportunities, and developing mindfulness (DelGuidice-Calemmo & Luna, 2017). Still others have noted the natural ties between maker programs and learning standards, and allowing students to drive their own learning (Canino-Fluit, 2014; Daley & Child, 2015). This discussion indicates school library based makerspaces provide support for curricular and social emotional needs of students. At the same time, while previous studies have explored outcomes for participants in maker programs, they have not explored the consequences for the school, the school library, or the school librarian.

Despite the growth of maker programs in school libraries, literature on the topic is still scant and little is known about the adoption of maker programs in school libraries. The aim of this study is to better understand maker programs in school libraries utilizing Rogers’ diffusion of innovations theory. Roger’s (2003) diffusion of innovations theory explains the process of innovation adoption from decision through implementation. This study has two research questions:

R1. What drives the adoption of maker programs in school libraries?

R2. What are the consequences of implementing maker programs in school libraries?
To answer the research questions above, this study uses the case of makerspaces in school libraries across PreK-12 public schools in New York State and employs a qualitative approach.

Two data sets are used to answer the research questions. The first data set is a survey of 584 New York State School librarians outside of New York City that was disseminated in Spring 2020. The second data set includes transcripts of semi-structured interviews conducted in Spring 2022 with 20 New York State public school educators in 17 schools across 11 school districts that have a maker program in the school library. Analysis of open-ended survey data provides a broad picture of maker programs in New York State public school libraries, while the use of semi-structured interviews from educators in a wide variety of schools allows for detailed exploration. Both data sets were analyzed using directed content analysis (Maxwell, 2013), and are presented with rich description.

Findings from this study contribute to the information science literature, in particular to the subfield of school library research. It also contributes to the literature on makerspaces, and to the field of education research. First, this is an exploratory study of maker programs in a new setting – school libraries – which adds to what is known about maker programs. Second, this study identifies what drives school libraries to implement maker programs. In doing so, it uncovers important characteristics of the innovation, the organization, and the librarian that affect adoption. Third, this study identifies the consequences of implementing maker programs. Consequences have received little attention in diffusion research, however Rogers indicates that understanding the effects of innovations is perhaps more important than understanding what leads to adoption. Further, there exists no agreed upon theory about what it is that a school library or librarian provides, or what they do that influences student outcomes. This study
examines one potential contributor which adds to understanding school library effects. This research finds that the effects of implementing maker programs are often indirect, and far reaching – maker programs have consequences for students, school librarians, school libraries, and the school as an organization. At the same time, they have the potential to address larger societal problems. Further, implementing a maker program allows school librarians to enact each of the roles assigned to them: teacher, instructional partner, information specialist, program administrator, and leader.

Finally, as school libraries are considered applied information science, it is important to address the application, or practical contributions, this research makes. Research indicates that later adopters of innovations often wait for evidence of what an innovation does before adopting (Ertmer, 1999; Kebritchi, 2010; Rogers, 2003). This study uncovers a variety of consequences from maker programs, which may hold different levels of importance for different decision makers and may help guide decisions of school librarians and administrators considering creating a maker program.

The results of this study indicate that implementing maker programs can change perceptions about the school library, change how stakeholders view school and learning, and improve the climate of the school library. Implementing a maker program can lead to increased usage of the library by students and other educators, increased resource access and utilization, and allow school librarians to better support student learning. Maker programs provide new opportunities for collaboration between librarians and other educators, and lead to improved relationships with students. Maker programs help school librarians and other educators move from teacher-centered to more student-centered philosophies, and position school librarians as change agents in their schools and districts, as well as in the wider community. Adopting a
maker program appears to create opportunities for students to develop social emotional skills in all five CASEL competency areas: self-awareness, self-management, social awareness, responsible decision making, and relationship skills. These findings serve as a starting point to dig more deeply into the effects maker programs have on students, and the way schools and school libraries operate.

The flexible nature of maker programs in terms of materials and activities allow adopters to try small, less complex activities and materials before full implementation. This decreases uncertainty and allows educators to reinvent maker programs to meet the needs of the schools and libraries where they are implemented. At the same time, adopting a maker program leads to an increased workload for school librarians and other employees of the school, changes financial costs for the school and librarian, and increases risk. These consequences are related to obtaining, managing, and maintaining supplies, materials, and equipment, renovating or modifying the library space, training, and designing and implementing activities.

This study calls attention to the need for school library preparation programs to grow school librarians with the dispositions and skills necessary to successfully operate maker programs. Further, it calls attention to the need for administrators to provide support in terms of resources – time, funding, and training for school librarians and other educators in their schools – to successfully implement innovations. This research indicates that there are not yet sufficient materials available on implementing maker programs – therefore additional resources need to be created. At the same time, it confirms that educators, specifically school librarians, if sufficiently invested in the innovation will find creative ways to overcome obstacles.

**Definition of Terms**

Table 1 provides definitions of terms used throughout this dissertation.
<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
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<tr>
<td>Adoption</td>
<td>“A decision to make full use of an innovation as the best course of action available” (Rogers, 2003, p. 473)</td>
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<tr>
<td>Anticipated consequence</td>
<td>“are changes due to an innovation that are recognized and intended by members of the social system” (Rogers, 2003, p. 448)</td>
</tr>
<tr>
<td>Authority innovation-decision</td>
<td>“[c]hoice to adopt or reject an innovation that is made by a relatively few individuals in a system who possess power, status, or technical expertise” (Rogers, 2003, pp. 28, 473).</td>
</tr>
<tr>
<td>Certified school librarian</td>
<td>a state certified individual responsible for operating a library within a PreK-12 school building.</td>
</tr>
<tr>
<td>Change agent</td>
<td>“An individual who influences clients’ innovation-decisions in a direction deemed desirable by a change agency” (Rogers, 2003, p. 473)</td>
</tr>
<tr>
<td>Collective innovation-decision</td>
<td>“[c]hoice to adopt or reject an innovation that is made by consensus of the members of a system” (Rogers, 2003, p. 473)</td>
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<tr>
<td>Communication channels</td>
<td>&quot;the means by which messages get from one individual to another” (Rogers, 2003, p. 18)</td>
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<tr>
<td>Compatibility</td>
<td>“is the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters” (Rogers, 2003, pp. 15, 224, 473)</td>
</tr>
<tr>
<td>Complexity</td>
<td>“the degree to which an innovation is perceived as relatively difficult to understand and use” (Rogers, 2003, p. 16). Related to existing skills, existing knowledge</td>
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<tr>
<td>Consequences</td>
<td>“the changes that occur to an individual or a social system as a result of the adoption or rejection of an innovation” (Rogers, 2003, p. 436).</td>
</tr>
<tr>
<td>Contingent innovation-decision</td>
<td>“choices to adopt or reject that can only be made after a prior innovation-decision” (Rogers, 2003, p. 30).</td>
</tr>
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<td>Desirable consequences</td>
<td>“the functional effects of an innovation for an individual or for a social system” (Rogers, 2003, p. 442).</td>
</tr>
<tr>
<td>Diffusion</td>
<td>“The process in which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003, p. 474)</td>
</tr>
<tr>
<td>Innovation</td>
<td>“an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (Rogers, 2003, p. 475).</td>
</tr>
<tr>
<td>Innovativeness</td>
<td>“the degree to which an individual is relatively earlier in adopting new ideas than other members of a system” (Rogers, 2003, p. 267)</td>
</tr>
<tr>
<td>Librarian</td>
<td>an individual responsible for operating a library within a PreK-12 school building</td>
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<tr>
<td><strong>Maker activities</strong></td>
<td>activities that allow participants to utilize tools and materials to make things, to create new knowledge, or to solve problems.</td>
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<tr>
<td><strong>Maker program</strong></td>
<td>the presence of either maker activities or a dedicated makerspace.</td>
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<tr>
<td><strong>Makerspace</strong></td>
<td>an area that provides materials and tools (high tech, low tech, or no tech) to encourage individuals or groups to make things, to create new knowledge, or to solve problems.</td>
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<tr>
<td><strong>Norms of the social system</strong></td>
<td>“the established behavior patterns for the members of a social system. Norms define a range of tolerable behavior and serve as a guide or standard for the behavior of members of a social system. The norms of a social system tell individuals what behavior they are expected to perform” (Rogers, 2003, p. 26)</td>
</tr>
<tr>
<td><strong>Observability</strong></td>
<td>“The degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 475)</td>
</tr>
<tr>
<td><strong>Optional innovation-decision</strong></td>
<td>“[c]hoices to adopt or reject an innovation is made by an individual independent of the decisions by other members of the system” (Rogers, 2003, p. 475).</td>
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<tr>
<td><strong>Previous practice</strong></td>
<td>“practices that are already familiar to the individual” (Rogers, 2003, p. 254)</td>
</tr>
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<td><strong>Re-invention</strong></td>
<td>“The degree to which an innovation is changed or modified by a user in the process of its adoption and implementation” (476) “so as to customize it more closely to the individual’s conditions” (p. 258)</td>
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<tr>
<td><strong>Relative advantage</strong></td>
<td>“the degree to which an innovation is perceived as being better than the idea it supersedes” (p. 229). Advantage may be related to cost, time, social prestige</td>
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<td><strong>School library</strong></td>
<td>an information organization within a preK 12 school building which houses information resources appropriate to meet the educational needs of students and teachers in the building. (Also referred to as a media center, or school media center)</td>
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<td><strong>Socioeconomic characteristics</strong></td>
<td>may include age, wealth indicators, level of education, social status, and size of the organization (Rogers, 2003, p. 288)</td>
</tr>
<tr>
<td><strong>Trialability</strong></td>
<td>“the degree to which an innovation can be experimented with on a limited basis” (Rogers, 2003, p. 258)</td>
</tr>
<tr>
<td><strong>Unanticipated Consequences</strong></td>
<td>“are changes due to an innovation that are neither intended nor recognized by members of the social system” (Rogers, 2003, p. 448)</td>
</tr>
<tr>
<td><strong>Undesirable consequences</strong></td>
<td>“the dysfunctional effects of an innovation to an individual or to a social system” (Rogers, 2003, p. 442).</td>
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Chapter 2 presents a review of existing research and the analytical framework that was developed for this study. Chapter 3 presents the research design including the data sets, sampling
approach, collection methods, and analytical approaches. The results are presented in chapter 4, with a discussion in chapter 5. Chapter 6 provides a summary of findings, as well as contributions, implications, limitations and directions for future research.
Chapter 2: Literature Review

Making and makerspaces are heralded as a way to democratize access to ideas and tools that will enable people to become producers, rather than consumers, and allow everyone an opportunity to create and learn (Gershenfeld, 2010; Harron & Hughes, 2018; Martinez & Stager, 2013, 2019). It has been proposed that “making” holds the key to revolutionizing education and society (Dougherty & Conrad, 2016). Proponents of makerspaces believe that makerspaces have a positive effect on physical, social, emotional, and academic outcomes (Dougherty & Conrad, 2016; Martinez & Stager, 2013). Museums, community spaces, universities, academic, and public libraries, as well as PreK-12 schools, classrooms, and libraries, are creating makerspaces at a rapid pace. As making and makerspaces spread throughout the world, researchers are beginning to explore what they are and the effects they may have.

While making and makerspaces are often associated with technology like 3D printers, computer numerical control (CNC) machines, laser cutters, and other digital fabrication tools, there are other activities that can occur in a makerspace that do not use sophisticated technology (Martinez & Stager, 2019). This study defines a makerspace as an area that provides materials and tools (high tech, low tech, or no tech) to encourage individuals or groups to make things, to create new knowledge, or to solve problems. Maker activities are defined as activities that allow participants to utilize tools and materials to make things, to create new knowledge, or to solve problems. Finally, maker program is a broad term used to describe the presence of either maker activities or makerspaces.

In the following sections, the existing literature on makerspaces is reviewed, paying particular attention to the purposes and consequences of makerspaces, two of the most studied topics. Due to the lack of research on school library makerspaces, this literature review draws on
existing maker program, school library, education, and innovation research literature, as well as practitioner documents.

**Why are makerspaces being created?**

The Condition of Education 2018 report indicates that only 38% of fourth grade students in the United States scored at or above proficient on the 2015 National Assessment of Educational Progress (NAEP) science assessment, and only 22% of twelfth grade students scored at or above proficient (McFarland et al., 2018). The current initiative in the United States to increase science, technology, engineering, and math (STEM) skills of students may be one reason for the growth in makerspaces in schools. There has been much discussion in school and school library practitioner publications about the potential of makerspaces to increase STEM and STEAM outcomes for students (Baker & Alexander, 2018; Fourie & Meyer, 2015; Meyer, 2017). Recent research has also centered around these outcomes (Barton & Tan, 2018; Bean et al., 2015; Bevan et al., 2015; Clapp & Jimenez, 2016; Martin, 2015; Tan & Barton, 2018). At the same time, the literature suggests that there may be reasons to create a maker program beyond supporting STEM and STEAM outcomes.

In a series of interviews with educators leading makerspaces in PreK-12 schools, Harron & Hughes (2018) identified “five ways makerspaces supported school curriculum, including (a) making as a new curriculum, (b) using making-supported activities to support existing disciplinary curriculum, (c) connecting making to project-based learning (PBL), (d) using making as an extracurricular activity, and (e) using making as an alternative form of assessment” (p.262). The literature suggests that STEM learning creates new collaboration opportunities for school librarians (M. Subramaniam, 2015), and there are natural ties between multiple learning standards and maker style learning activities (Canino-Fluit, 2014; Daley & Child, 2015). Some
maker programs have been implemented to create new opportunities for graduation endorsements (Baker & Alexander, 2018), and to combine problem scoping and close reading (Blakemore, 2018). Others suggest makerspaces will allow libraries to “expand and extend connections to community and learning organizations, businesses, families, and mentors throughout the world” (Loertscher et al., 2013, p. 48).

At the same time, Harron & Hughes (2018) indicate “six major purposes for K–12 makerspaces including: making school more meaningful and relevant, preparing students for the future, creating an inclusive environment, developing student capacity for failure, showcasing the school campus, and helping students become creators instead of consumers” (p.259). This can be seen in both scholarly and practitioner literature with instances of maker programs being implemented as a way to be inclusive of LGBTQ students (Moorefield-Lang & Kitzie, 2018), support English Language Learners (Murph, 2018), and to address social and emotional needs such as to help students grieve for a lost classmate (Seymour, 2015). There have also been connections drawn between makerspaces and inquiry learning, providing student leadership opportunities, and mindfulness (DelGuidice-Calemme & Luna, 2017), and allowing students to drive their own learning (Canino-Fluit, 2014; Daley & Child, 2015).

Makerspaces provide multiple entry points into creating and lead to combinations of disciplines that have been traditionally separated. For example, sewing, computer programing, and electronic circuitry can be combined to create a flashing safety vest for bicycle riders (Blikstein et al., 2016); computer programming and physical computing components can be combined with cardboard and LEGOs to create robots (Blikstein et al., 2016); old stuffed animals and circuitry components can be combined to make noisemakers (Moriwaki et al., 2012); LEGOs can be combined with physical computing parts to create a low-cost Braille
printer (Wilkinson, 2015); and plastic cups, plastic spoons, corks, magnets, and copper wire can be combined to create a working portable hydroelectric generator (Mersand, 2017). Many makerspaces offer opportunities for people to participate in workshops and classes, and participants have the potential to be learners, mentors, and leaders. Makerspaces offer opportunities for individuals to explore tools, materials, concepts, learning experiences, and disciplines that they may not have experienced before.

There are a multitude of configurations for maker programs. They may be: 1) open access, where users have free reign to do as they wish with available tools and materials; 2) curriculum based, where users participate in activities aligned to a curriculum; 3) scripted, where users participate in activities designed by a program director or makerspace member, but not necessarily tied to a curriculum; or 4) any combination of the above (Burke, 2013; Chu et al., 2017; Gierdowski & Reis, 2015; Harron & Hughes, 2018). In a makerspace, participants may work individually, collaborate on group projects, attend workshops, or help to host community events (Sheridan et al., 2014). The objective of a project may be to solve a problem, to help another maker, or to figure out how a particular tool or combination of tools work. How a maker program is accessed and used by participants may speak to the reason it was created.

Despite the potential of maker programs to provide opportunities for students to engage in unique experiences, the maker movement and makerspaces have been criticized for being white, wealthy, and male dominated (Bucheley, 2014). There have been concerns raised about whether maker programs are contributing to the digital divide due to the high costs associated with materials and tools, particularly those related to technology (Hughes & Morrison, 2018).

The digital divide refers to inequalities in access to technology – specifically it is a lack of access most often experienced by those with low income, individuals in rural and inner-city
locations, and among minorities. Recently scholars and practitioners have drawn attention to the fact that it is not only lack of access to technology, but also lack of knowledge and skills in how to use the technology that is leaving some individuals behind in what has been coined the information age (Cohron, 2015; Huffman, 2018). This phenomenon has also been referred to as a “participation divide”, which suggests that students in lower socioeconomic groups have less opportunities to create media than their higher socioeconomic counterparts (Lahana, 2018).

Much research and discussion has focused on how maker programs have the potential to bring learning opportunities to underserved and at-risk youth (Barton et al., 2016; Bevan, 2017; Hira et al., 2014; Holbert, 2016a; Ryoo & Calabrese Barton, 2018).

Another reason school libraries may be implementing maker programs is to change perception of their value and worth. When espousing the potential benefits of makerspaces in school libraries, Wong (2013) notes that some believe libraries are antiquated and unnecessary, and adding a makerspace will keep them relevant. School librarians are advocating to reimagine library spaces, and explaining why makerspaces belong in school libraries:

- We can no longer remain book warehouses. We need to provide space for collaboration, for students to work on projects. We need the flexibility of a multi-functional, technology-rich space. We need to be able and willing to change to meet the needs of our students. (Rendina, 2014)
- Because libraries are at the center of student activity, incorporating a makerspace into the library helps connect curriculum, improve student achievement, and invest in a student’s creative journey. (EveryLibrary, 2021)

Given the discussion in practitioner arenas, it is possible school libraries see the potential of maker programs to revitalize their programs.
The literature suggests that there may be many reasons schools and school libraries are implementing maker programs including: to support existing programs and curriculum; to address technology, educational, and achievement gaps; to provide new ways for students to learn and engage in learning; to address academic or social emotional needs; or to revitalize spaces that have been deemed unnecessary with advances in technology. The reasons for maker program implementation will affect the consequences – both those that are anticipated, and those that are realized.

**What are the consequences of maker programs?**

Given the variety of reasons for implementing maker program adoption, there are likely a variety of consequences as well. However, the existing literature mainly focuses on the consequences for students participating in maker programs, largely ignoring the consequences for schools and librarians.

In general, when it comes to student-related outcomes, these are mainly positive. As Papavlasopoulou, Giannakos, & Jaccheri (2017) note, existing research “highlighted making only in a positive way as almost none of the studies reported negative effects” (p. 63). Further, these outcomes have to do with student’s learning processes which are often broadly categorized into three domains: cognitive outcomes deal with knowledge and the development of understanding; psychomotor (or physical) outcomes deal specifically with physical skills; and affective outcomes (also referred to as social emotional outcomes) deal with attitudes, beliefs, and feelings (Anderson & Krathwohl, 2001). Another type of outcome is behavioral, and includes measures of behavior such as student attendance and suspensions (Steinberg & MacDonald, 2019). The research indicates that makerspaces can provide opportunities for participants to grow in each of the learning domains and may influence behavioral outcomes as
well. At the same time, the literature suggests that the framing of maker activities has an effect on those outcomes.

Cognitive outcomes from participation in makerspace activities may be the development of understanding by expressing realization through affect or utterances, offering explanation(s) for a strategy, tool or outcome, applying knowledge, striving to understand (Bevan et al., 2015), an increased knowledge of how circuits work, the ability to sketch a functional circuit, or the ability to read and decipher Arduino code (Litts et al., 2017).

Psychomotor skills may include music editing, bike repair, video creation and editing, silk-screening (Sheridan et al., 2014) as well as mastery of the use of a tool or set of tools (Wilson & Gobeil, 2018), among others, depending on materials available and participants in a makerspace.

Affective outcomes appear to be one of the most frequent focuses of studies. Previous literature has identified affective outcomes from maker program participation such as the development of self-sustained learning practices (Barron, 2006), dispositional shifts in interest in a subject, confidence in a skill (Sheridan et al., 2014), and development of positive self-concept and self-image (Norris, 2014). Other affective outcomes include engagement in terms of motivation and investment in projects and the makerspace (Bevan et al., 2015; Bull et al., 2017), collectively formed interests (Barton et al., 2016), and engagement in projects based on personal connections (Wilson & Gobeil, 2018). Users in a makerspace may demonstrate initiative and intentionality – including goal setting, seeking and responding to feedback, persisting to achieve goals in the problem space, taking intellectual risks and/or showing intellectual courage, as well as requesting or offering to help solve problems, inspiring new ideas or approaches, or connecting to others’ work (Bevan et al., 2015). Users may also demonstrate growth in areas of
empowerment in social competencies, confidence, self-regulation, and empathy (Bar-el et al., 2016), as well as the ability to embrace failure as a learning opportunity (Bowler & Champagne, 2016). Researchers have also explored the development of a maker mindset measuring self-efficacy, motivation, interest, development of maker identity (Chu et al., 2015; Flores, 2017), and STEM identity (Davis & Mason, 2016; Flores, 2017).

Research indicates behavioral outcomes may be influenced by participation in maker programs as well. Kulkarni, Ballal & Gawade (2012) and Wilson & Gobeil (2018) found decreases in student absenteeism from school when maker-style programs were offered.

The literature suggests there are several factors that may lead to differences in outcomes from participating in maker programs, including how community is formed in a makerspace, and how activities are structured. Barron (2006) identified the importance of what students are exposed to, and the supports they receive – from friends, family and other adults – in development of interest and self-directed learning. Bevan, Gutwill, Petrich & Wilkinson (2015) identified social scaffolding – helping each other, asking questions, and working together – as important in the learning process during making activities. Similarly, in the Bots for Tots program (Holbert, 2016b), as participants worked on their designs, they shared ideas and offered advice to each other. The collective nature of a makerspace may allow for the development of collaboration skills, and keep participants engaged when they hit roadblocks, helping them persevere through problems and setbacks by providing encouragement and advice (Barton et al., 2016; Holbert, 2016b).

While participants may work individually, in small groups, or collaboratively in community projects, individuals in makerspaces have identified “the people” as the most valued aspect of the makerspace (Sheridan et al., 2014). The participants interviewed in Bean, Farmer &
Kerr (2015) identified the social aspect of making as the reason they belong to the makerspace. Benjes-Small et al., (2017) also identified relationships, partnerships, and a sense of community as important aspects in makerspaces. Bers, Strawhacker & Vizner (2018) found that artifacts such as images of others’ work helped to build community in the space. The building of community within a makerspace appears to affect whether participants continue to use the makerspace, the sense of ownership they feel over the space and their projects, their perseverance in working through setbacks, and the outcomes from participating in the space.

How maker activities are structured also plays a role in the outcomes from the experience. In a lab experiment, Blikstein, Gomes, Akiba & Schneider (2017) set out to determine how the structure of directions for an activity affected student task performance. The researchers found that detailed instructions and generic instructions led to no differences in task performance, however they did lead to differences in arousal level as measured by Galvanic Skin Response. Conversely, Smith, Iversen, & Hjorth (2015), in observational studies of two schools in Denmark that had recently installed FabLabs, found that loosely framed projects with no criteria or guidance led to student frustration.

Bekker, Bakker, Douma, van der Poel & Scheltennar (2015), when exploring the effects of tool properties on design based learning experiences, identified the importance of providing support during the design process. Barton et al. (2016), found that different supports, or instructional practices, were necessary for students who had no previous exposure to a domain area such as circuitry, identifying “just in time” supports as important to sustaining engagement in making and makerspace projects. Hughes & Morrison (2018) similarly found that different supports are needed by different groups of students (low-socioeconomic status vs higher socioeconomic status, gifted students vs students with IEPs) based on prior exposure and
understanding of concepts such as pre-planning, self-regulation, collaboration, and self-direction. Although Hughes & Morrison (2018) identified differences in the type of support needed between economically advantaged and disadvantaged youth participating in makerspaces, Beyers (2010) found that all students, regardless of the school they attended (high or low socioeconomic need), were able to participate at similar levels in a FabKids pilot project.

Fields, Kafai, Nkajimi, Goode & Margolis (2018) found that the teaching practices used during maker activities have an effect on student outcomes for at-risk students. In particular, valuing student expertise and encouraging students to peer teach led participants to dig more deeply into how e-textiles work and to figure out how to debug their projects. This teaching practice empowered the students to take ownership over the projects and encouraged students to self-regulate their learning.

Barton et al. (2016) found that making connections to problems youth identified as relevant in their communities contributed to perseverance in creating potential solutions. Similarly, Holbert (2016a) found that framing maker activities as a way to connect with the community increased young female’s motivation, persistence and interest in the activities. Likewise, Hughes & Morrison (Hughes & Morrison, 2018) found that making for a purpose is one of the vital elements that promotes investment in the work, which leads to increased innovation and conceptual understanding.

Despite the large body of literature on student outcomes, there seems to be much less research on the impact of makerspaces in the organization. The limited number of studies on this topic mainly address skills and competencies and materials and equipment needed to successfully implement makerspaces. First, the wide variability in the outcomes from maker program participation, and how community formation and structure of activities affects outcomes
suggests there may be specialized training necessary to successfully implement a maker program.

Koh & Abbas (2015, 2016) and Abbas & Koh (2015) identified skills and competencies necessary to operate a makerspace related to:

(1) technology, (2a) teaching/programming, (2b) learning, (3) community advocacy and partnerships, (4) flexibility/adaptability, (5) understanding diverse users, (6) management, (7) communication skills, (8) curiosity, (9) creativity, (10a) patience, and (10b) subject content knowledge and skills (Koh & Abbas, 2016, p. 11).

These competencies align with findings regarding needs of individual users in makerspaces, however a vast majority of the respondents in Koh and Abbas’ study indicated their educational preparation was only somewhat relevant to prepare them to administer makerspaces. Similar concerns about appropriate preparation and training have been raised by other researchers (Hira et al., 2014).

Respondents in the Koh and Abbas studies indicated they most frequently obtained the skills necessary to operate a makerspace by learning on the job, learning on their own, and networking with other professionals. Very few indicated they had taken additional coursework or attended professional development opportunities. Horton (2019) found that the types of professional development makerspace operators engage in varied based on the type of library they work in; school librarians are more likely to utilize workshops, conferences, visits to other makerspaces, books, and online tutorials as methods to gain knowledge of topics related to makerspaces than their counterparts in academic and public libraries.

Second, it is no surprise, given the range of potential activities in a makerspace, that making involves a variety of materials for users to work with. The literature suggests that the
tools available in a maker program may influence outcomes. Christensen & Iverson (2017) observed children’s interactions with maker technologies in Danish schools and looked at form properties – size, intended function, and feedback channels – to create a framework to help designers and buyers of such technologies identify potential opportunities and barriers to use and learning. Bekker et al. (2015) tested tool kits designed specifically for makerspaces to determine the tools’ role in teaching design thinking skills and identified the importance of matching learning goals, learning approaches, interests, age, activities, and relevance with the tools provided to participants.

Research indicates that makerspaces offer materials to explore concepts such as circuitry, fabrication, physics, and computer programming. These materials may include circuit boards, wires, light bulbs, buzzers, generators, doorbells, batteries (Bevan et al., 2015), circuit blocks, paper clips, motors from old toys, speaker cables, voltmeters, soldering irons, oscilloscopes (Sheridan et al., 2014), battery-operated motors, LED lights, and soldering irons (Bowler & Champagne, 2016). There may also be materials for non-digital fabrication such as fiber arts - sewing machines, thread, needles, pins, bolts of fabric, fabric scraps, and foot pedal operated looms (Sheridan et al., 2014) - as well as items such as glue guns (Bowler & Champagne, 2016), boards and bolts for building, tools for construction, woodworking tools, kilns, recycled materials, bits of paper, cellophane (Sheridan et al., 2014), pipe cleaners, cardboard tubes and tape (Bevan et al., 2015).

Makerspaces may have tools for digital fabrication like those found in fablabs such as 3D printers and laser cutters (Benjes-Small et al., 2017; Sheridan et al., 2014), as well as digital tools for drawing images, editing photos, remixing video clips with audio overlay, making music and musical instruments, animating stories (Benjes-Small et al., 2017; Bowler & Champagne, 2016)
and stop-motion animation (Sheridan et al., 2014). Objects to explore computer programing may include wooden blocks for object-oriented programing (Sheridan et al., 2014), computers (Barron, 2006; Benjes-Small et al., 2017) and robots and robotics materials (Bowler & Champagne, 2016).

Although evidence of the consequences of maker program implementation can be extrapolated from the literature, the focus of studies is most often on the educational consequences for students. The literature suggests there may also be consequences for the facilitators, as well as the organization when implementing a maker program, however there does not appear to be a concerted effort to explore these consequences.

Gaps

The review above shows that, although a lot has been written about makerspaces, the literature is fragmented (Mersand, 2021a). In general, there seems to be a limited focus on the use of makerspaces in education and information science and on the intersection of these two disciplines. Further, the few studies that address makerspaces in these fields also seem to overlook the study of makerspaces in school settings. As schools continue to invest time and money in school library maker programs, it is important to better understand why programs are being created, and the effects they have.

It is clear from existing literature that there are wide disparities in the types of makerspaces as far as setting, materials, components, and equipment. There are also differences in how the space is used in regard to content, purpose, and structure of activities, all of which ultimately leads to differences in anticipated and realized consequences.

The literature suggests that implementing maker programs may be more complex than the adoption of other innovations such as a new piece of software, or a new piece of equipment, and
there may be a multitude of reasons school libraries are implementing them. There appears to be little examination of what drives the decision to adopt maker programs, particularly in school libraries. Whether an adopter will continue or discontinue adoption relies on a match between the expected and realized outcomes. Without knowing the reasons school librarians create maker programs, it is difficult to determine if the intended outcomes have been realized.

Previous research has identified cognitive, psychomotor, behavioral, and affective outcomes from maker activities, however it is unclear if these same outcomes are realized in school library based makerspaces. It is important to determine if makerspaces in school libraries have similar outcomes as those in other organizations, or if the necessity to meet school building and district goals changes the intended and realized outcomes from participating in making activities.

At the same time, there is no structured examination of the consequences maker program implementation has on the organization, or on school librarians. First, the literature seems to only focus on the positive outcomes, but there is a need to better understand if outcomes can also be negative. Second, the literature reveals that there may be characteristics of makerspace facilitators, including beliefs, experience, and training in facilitation methods, that lead to specific outcomes, therefore, it is important to determine if the same characteristics and training are relevant in school libraries, and whether more specialized training for school librarians is needed to prepare them to create and operate such spaces. Third, understanding consequences of makerspaces in school libraries in a consistent way may also have important practical implications, as it may lead to practical recommendations that help schools address the negative consequences of makerspaces.
This study addressed three gaps. First, this study explores maker programs in a new setting – school libraries. Second, this project explores the drivers of maker program adoption in school libraries. Third, this project explores the consequences of implementing a school library maker program – for students, librarians, and the school. These gaps are explored using an analytical framework based on Rogers’ diffusion of innovations theory, which is discussed in the next section.

**Analytical Framework**

This study uses an analytical framework based on Rogers’ diffusion of innovations. Rogers defines an innovation as “an idea, practice, or object that is perceived as new by an individual or other unit of adoption” (2003, p. 475). Rogers defines adoption as “a decision to make full use of an innovation as the best course of action available” (2003, p. 473). Maker programs may be considered an innovation because they are a new practice that has the potential to change how school libraries operate. Maker programs may also be viewed as a collection of innovations: they are on one hand a technology innovation as many makerspaces may be equipped with technology like 3D printers, robots, and microcomputers; on the other hand, they are a pedagogical innovation in that they ask educators to rethink teaching and learning. When developed within a school library, maker programs can be a resource that is integrated throughout the school curriculum, therefore they have the potential to affect the entire school community.

**Rogers’ Diffusion of Innovations Theory**

Rogers defines diffusion as “[t]he process in which an innovation is communicated through certain channels over time among the members of a social system” (2003, p. 474). Rogers’ diffusion of innovations theory is widely used to understand how innovations spread
throughout populations. As indicated in the definition, there are four main elements that contribute to the diffusion of an innovation – communication channels, a social system, time, and characteristics of the innovation. Rogers’ theory is vast and complex, this study uses one part of the theory, the innovation decision process.

The innovation decision process is the process individuals go through as they determine whether to adopt an innovation. Rogers identifies three main types of innovation decisions – optional, collective, and authority. The theory also indicates a fourth type – contingent. Optional innovation-decisions are when the “[c]hoice to adopt or reject an innovation is made by an individual independent of the decisions by other members of the system” (p. 475). A collective innovation-decision is a “[c]hoice to adopt or reject an innovation that is made by consensus of the members of a system” (p. 473). An authority innovation-decision is a “[c]hoice to adopt or reject an innovation that is made by a relatively few individuals in a system who possess power, status, or technical expertise” (Rogers, 2003, pp. 28, 473). Finally, “[c]ontingent innovation-decisions are choices to adopt or reject that can only be made after a prior innovation-decision” (p. 30).

Rogers’ model (Figure 1) includes five stages in the innovation-decision process: knowledge, persuasion, decision, implementation, and confirmation. Additionally, Rogers indicates prior conditions that affect the process, including previous practice, needs or problems the adopters wants to address, innovativeness (of the adopter) and norms of the social system. Each of these prior conditions play a role in different stages. This study focuses on the last four stages in the innovation decision process – persuasion, decision, implementation, and confirmation.

Figure 1
Factors Contributing During the Innovation Decision Process


**Persuasion**

The persuasion stage is when an individual forms an opinion about the innovation. During this stage, the perceived characteristics, or the attributes of the innovation, are important.

**Perceived Characteristics of the Innovation**

According to Rogers (2003), of the five types of variables that influence innovation adoption, the perceived characteristics of the innovation - relative advantage, compatibility, complexity, trialability and observability - explain about half of the variance. Roger’s generalizations indicate that complexity is negatively associated with the rate of adoption, while the other four characteristics are positively associated.

*Relative advantage* refers to the perceptions the adopter holds about whether an innovation will be better or worse than the existing way of doing things – previous practice (Rogers, 2003). Some suggest that the new way does not have to be better than, only substantially different from, existing practice (McGrath, 2015). Rogers explains that relative
advantage is “a ratio of the expected benefits and the costs of adoption of an innovation” (p. 233). Rogers further explains "[s]ubdimensions of relative advantage include economic profitability, low initial cost, a decrease in discomfort, social prestige, a saving of time and effort, and immediacy of reward" (p. 233).

Compatibility “is the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters” (pp. 15, 224, 473). Rogers further explains "[a]n innovation can be compatible or incompatible with (1) sociocultural values and beliefs, (2) previously introduced ideas, and/or (3) client needs for the innovation" (p. 240). Rogers also explains “previous practice provides a standard against which an innovation can be interpreted, thus decreasing its uncertainty” (p. 243), and “the more compatible an innovation is [with previous practice], the less of a change in behavior it represents” (p. 245).

Complexity is “the degree to which an innovation is perceived as relatively difficult to understand and use” (p. 16). Rogers explains “[n]ew ideas that are simpler to understand are adopted more rapidly than innovations that require the adopter to develop new skills and understandings” (p. 16). Rogers also explains that complexity is related to knowledge and information seeking.

Trialability refers to how accessible the innovation is – how easy an innovation is to try out before a full commitment to the innovation is made (p. 258). Rogers theory indicates that innovations that can be tried out in pieces have a faster rate of adoption, and that trialability is linked to re-invention.

Observability is “the degree to which the results of an innovation are visible to others” (p. 475). Rogers also notes observability is related to how easy it is to communicate the results.
Research indicates that there is unspoken peer pressure playing a role – the idea that everyone else is doing it makes an innovation more likely someone will adopt it (Sträub, 2009).

**Decision**

The decision stage is when an individual “engages in activities that lead to a choice to adopt or reject an innovation” (p. 177). During this stage a unit may partially adopt an innovation to try it out before making a full commitment, and may seek additional information. Rogers (2003) also notes that it is not always necessary for the individual to try the innovation themselves, that in some cases “trial of a new idea by a peer can substitute, at least in part” (p. 177).

**Implementation**

The implementation stage is when the innovation is used. Rogers notes that this stage often involves active information seeking on the part of the adopter as they learn to use the innovation. It is during this stage that re-invention occurs. Rogers’ generalizations about re-invention include: re-invention occurs during the implementation stage for many innovations and adopters, a higher degree of re-invention leads to a faster rate of adoption, and a higher degree of sustainability (Rogers, 2003, p. 183). At the same time, Rogers (2003) indicates that re-invention may lead to misuse of an innovation, particularly if the adopter does not have enough principles knowledge.

**Confirmation**

During the confirmation stage, the adopter determines whether to continue to utilize the innovation. During this stage the adopter “seeks reinforcement of an innovation-decision already made” (Rogers, 2003, p. 169). It is possible to adopt an innovation, then in the confirmation stage decide the innovation does not work as intended and discontinue. It is also possible that the
unit decides to reject initially, but after further exposure decides to adopt. It is during this stage that the consequences of adopting the innovation become important, when an individual decides if the consequences make the adoption worth continuing.

**Consequences**

Rogers defines consequences as “the changes that occur to an individual or a social system as a result of the adoption or rejection of an innovation” (p. 436). Consequences have received little attention in diffusion research, however Rogers indicates that understanding the effects of innovations is perhaps more important than understanding what leads to adoption. Rogers identifies three ways to classify consequences: “(1) desirable versus undesirable, (2) direct versus indirect, and (3) anticipated versus unanticipated” (p. 442).

*Desirable* consequences are “the functional effects of an innovation for an individual or for a social system” (Rogers, 2003, p. 442). *Undesirable consequences* “are the dysfunctional effects of an innovation to an individual or to a social system” (Rogers, 2003, p. 442). Rogers states that innovations may have desirable consequences for an individual but not the social system, and vice versa, and that the same holds true for adopters and non-adopters. *Anticipated consequences* are changes that are “recognized and intended”, while *unanticipated consequences* are those unknown at the time of adoption. *Direct consequences* are immediate, while *indirect* are the changes that occur as a result of the direct consequences – a chain reaction. Rogers’ theory indicates that because innovations are adopted more rapidly by those of higher socioeconomic status, there are often unequal distribution of consequences, and often serve to widen already existing gaps.
Table 2 summarizes the constructs, definitions, and operationalization for this study, as well as examples to look for. Constructs are operationalized based on the theoretical framework, the literature review, as well as the researcher’s professional background and experience.

**Table 2**

*Construct Operationalization*

<table>
<thead>
<tr>
<th>Construct</th>
<th>Definition</th>
<th>Operationalization</th>
<th>Examples to look for</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of Innovation Decision</td>
<td></td>
<td>Who makes the decision to adopt the innovation?</td>
<td>Optional, collective, authority, contingent</td>
</tr>
<tr>
<td>Authority innovation-decision</td>
<td>“[c]hoice to adopt or reject an innovation that is made by a relatively few individuals in a system who possess power, status, or technical expertise” (Rogers, 2003, pp. 28, 473).</td>
<td>Indication that someone in power (administrator) made the decision</td>
<td></td>
</tr>
<tr>
<td>Collective innovation-decision</td>
<td>“[c]hoice to adopt or reject an innovation that is made by consensus of the members of a system” (Rogers, 2003, p. 473).</td>
<td>Indication that the school librarian made the decision with someone else</td>
<td></td>
</tr>
<tr>
<td>Contingent innovation-decision</td>
<td>“choices to adopt or reject that can only be made after a prior innovation-decision” (Rogers, 2003, p. 30).</td>
<td>Indication that one person made the decision and another person followed. This may be librarian then administrator, or previous librarian (space already existed), or indication that it was expected but the librarian also wanted to adopt</td>
<td></td>
</tr>
<tr>
<td>Optional innovation-decision</td>
<td>“[c]hoices to adopt or reject an innovation is made by an individual independent of the decisions by other members of the system” (Rogers, 2003, p. 475).</td>
<td>Indication that the school librarian made the decision</td>
<td></td>
</tr>
<tr>
<td>Previous Practice</td>
<td>“practices that are already familiar to the individual” (Rogers, 2003, p. 254)</td>
<td>What is the previous practice of the individual?</td>
<td>May include collaboration, curriculum, standards, assessment practices, teaching practices</td>
</tr>
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<td>-------------------</td>
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<td>-------------------------------------------------</td>
<td>-------------------------------------------------</td>
</tr>
<tr>
<td>Felt needs/problems</td>
<td>something an individual or organization feels needs to change or be solved</td>
<td>What are the felt needs/problems of the individual?</td>
<td>In the library</td>
</tr>
<tr>
<td>Social System Support</td>
<td>Endorsement or use of school library, collaboration, advocating on the part of the administration, teachers, and students</td>
<td>What indication of support from members of the social system is evident?</td>
<td>Collaboration, library usage, verbal support</td>
</tr>
<tr>
<td>Administrative Support</td>
<td>Allocation of resources such as funding, staffing, space, time, training, and other resources</td>
<td>What indication of support from the administration is evident?</td>
<td>Funding, staffing, space, time, training, and other resources</td>
</tr>
<tr>
<td>Communication Channels, Communication behavior</td>
<td>&quot;the means by which messages get from one individual to another&quot; (Rogers, 2003, p. 18)</td>
<td>To what extent is the individual connected to interpersonal, mass media, and internet communication channels?</td>
<td>Professional Development programs, certifications and coursework, online and physical resources, immediate and extended social systems, professional organizations, conferences, professional publications, professional</td>
</tr>
<tr>
<td>How an individual seeks information about innovations</td>
<td>Access to technical training, and support such as models, examples, and exemplars of the innovation.</td>
<td>What is the communication behavior of the decision-making unit?</td>
<td></td>
</tr>
<tr>
<td>Relative Advantage</td>
<td>“the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 2003, p. 229). Advantage may be related to cost, time, social prestige</td>
<td>decision-making unit?</td>
<td>To what extent is the innovation perceived as better or worse than existing/previous practice? What are the expected costs of the innovation? What are the expected benefits of the innovation?</td>
</tr>
<tr>
<td>-------------------</td>
<td>-------------------------------------------------</td>
<td>---------------------</td>
<td>-------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Compatibility</td>
<td>“is the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters” (Rogers, 2003, pp. 15, 224, 473)</td>
<td>To what extent is the innovation compatible with previous practice? To what extent is the innovation compatible with previously held beliefs? To what extent is the innovation compatible with felt needs/problems?</td>
<td>Indication of perceived compatibility (or incompatibility) with values (beliefs, values, traditions, and habits that influence everyday behavior), previous practice, felt needs/problems</td>
</tr>
<tr>
<td>Complexity</td>
<td>“the degree to which an innovation is perceived as relatively difficult to understand and use” (Rogers, 2003, p. 16). Related to existing skills, existing knowledge</td>
<td>To what extent is the innovation perceived as difficult to understand? To what extent is the innovation perceived as difficult to use? To what extent does the innovation require the individual to acquire new skills?</td>
<td></td>
</tr>
<tr>
<td>Observability</td>
<td>“The degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 475)</td>
<td>To what extent are the results of an innovation visible?</td>
<td>Evidence of seeing results</td>
</tr>
<tr>
<td>Trialability</td>
<td>“the degree to which an innovation can be experimented with on a limited basis” (Rogers, 2003, p. 258)</td>
<td>To what extent can the innovation be tried/experimented with in small parts?</td>
<td>Indication of ability to experiment with the innovation before full adoption through partial adoption or training opportunities</td>
</tr>
<tr>
<td>Re-invention</td>
<td>“The degree to which an innovation is changed or modified by a user in the process of its adoption and implementation” (Rogers, 2003, p. 476) “so as to customize it more closely to the individual’s conditions” (Rogers, 2003, p. 258)</td>
<td>To what extent has the innovation been modified to fit the social system?</td>
<td>Indication of the innovation being modified or changed to align with social system, needs</td>
</tr>
<tr>
<td>Attitudes</td>
<td></td>
<td>What are the attitudes of the decision-making unit?</td>
<td>Regarding the innovation, regarding student learning, regarding change</td>
</tr>
<tr>
<td>Beliefs</td>
<td></td>
<td>What are the beliefs of the individual?</td>
<td>Regarding the innovation, regarding student learning, regarding change</td>
</tr>
<tr>
<td>Consequences</td>
<td>“the changes that occur to an individual or a social system as a result of the adoption or rejection of an innovation” (Rogers, 2003, p. 436).</td>
<td>What consequences are evident from implementing the innovation?</td>
<td>For students? For the library? For the librarian? For the school? For other members of the social system?</td>
</tr>
<tr>
<td>Anticipated Consequences</td>
<td>“are changes due to an innovation that are recognized and intended by members of the</td>
<td>What outcomes do participants anticipate?</td>
<td></td>
</tr>
</tbody>
</table>

35
<table>
<thead>
<tr>
<th>Consequences</th>
<th>Definition</th>
<th>Questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unanticipated</td>
<td>“are changes due to an innovation that are neither intended nor recognized by members of the social system” (Rogers, 2003, p. 448)</td>
<td>What outcomes did participants not anticipate?</td>
</tr>
<tr>
<td>Desirable</td>
<td>“the functional effects of an innovation for an individual or for a social system” (Rogers, 2003, p. 442)</td>
<td>What positive changes have occurred from adoption?</td>
</tr>
<tr>
<td>Undesirable</td>
<td>“the dysfunctional effects of an innovation to an individual or to a social system” (Rogers, 2003, p. 442).</td>
<td>What negative changes have occurred from maker program adoption?</td>
</tr>
</tbody>
</table>

Note: This table represents constructs, variables, and potential measures from Rogers’ diffusion of innovations theory.
Chapter 3: Research Design

The purpose of this study was to understand the adoption of maker programs in New York State PreK-12 public schools. This study had two research questions:

R1. What drives the adoption of maker programs in school libraries?

R2. What are the consequences of implementing maker programs in school libraries?

This study uses an embedded case study approach (Yin, 2017, p. 64) that examines a smaller population of school libraries, within the larger population of school libraries throughout New York State. Qualitative data used in this study includes open ended survey questions, and semi-structured interviews.

Survey data is used “to generalize results to a population” (Creswell, 2009, p. 21). The survey collected preliminary information about makerspaces in New York State Public School libraries, which allowed the researcher to better understand the drivers and intended consequences of maker program adoption. Survey data was then used to identify potential cases, as well as to inform interview protocols. Finally, semi-structured interviews of 20 individuals were conducted to understand the consequences of implementing maker programs in school libraries in detail.

A case study approach is appropriate when “the inquirer has clearly identifiable cases with boundaries and seeks to provide an in-depth understanding of the cases or a comparison of several cases” (Creswell & Poth, 2018, p. 100) and for exploring “complex social phenomena” (Yin, 2017, p. 5). A case study approach was chosen as it allowed for an in-depth description of the phenomenon in specific instances, and also allowed for comparison of the phenomenon across settings (Creswell & Poth, 2018). Although case-study research is currently the
predominant form of study in makerspace and school library research – the use of multiple cases, specifically more than three cases, is less evident. This study analyzes multiple schools and school districts throughout New York State. The use of multiple study sites is analogous to the use of replication studies in quantitative approaches in that they have the benefit of exploring a phenomenon across a wide variety of contexts to identify if there are similarities - theoretical replication of findings (Yin, 2017). Case studies are imperative when understanding a real-world case “is likely to involve important contextual conditions pertinent to your case” (Yin, 2017, p. 15).

Further, case studies are appropriate for answering research questions that ask how and why, focus on contemporary events, and do not require control over behavioral events (Yin, 2017, p. 9). Although the research questions use “what,” in this study the “what” helps to uncover how and why makerspaces are being created, as well as how and why they work (or don’t work) (Yin, 2017, p. 11). Case studies are used to “enlighten those situations in which the intervention being evaluated has no clear, single set of outcomes” (Yin, 2017, p. 18) as is the case here.

**Case Selection – Study Population**

PreK-12 public school libraries in New York State were chosen as the study population for several reasons. First, the use of New York State public school libraries as the study population increases generalizability due to the percentage of school libraries and school librarians it represents in the United States. According to the National Center for Education Statistics, in the 2017-2018 school year, there were 98,507 operational public schools in the United States, and 43,605 full time equivalent school librarians employed in school libraries in the United States (U.S. Department of Education National Center for Education Statistics, 2018a,
New York State has the third largest number of public schools (4,795) which represent 5% of public schools in the United States. New York State has the second largest number of school librarians in the United States, with 2,593 full time equivalent school librarians, representing 6% of school librarians employed in public schools in the United States.

New York State is diverse in terms of types of schools, communities, and residents. Of the 4,724 traditional public and charter schools reporting data to the New York State Education Department during the 2017-2018 school year, 45% (2,130) are located in cities, 32% (1,498) in suburban areas, 8% (353) in areas classified as town, and 16% (742) are classified as rural. Of the 4,724 schools, 4,396 (93%) indicated that there is a physical space in the school dedicated as a school library or library media center. Of those 4,396 schools, 4,291 (91%) are traditional public schools, 105 (2%) are charter schools; 1,582 (36%) are located in New York City, and 2,814 (64%) are located in the rest of the state. In terms of maker programs, in the fall of 2018, 19.1% (836) of schools with a school library reported having a dedicated makerspace in the school library during the 2017-2018 school year, 28.3% (1,241) indicated incorporating maker activities in the 2016-2017 school year.

Second, the researcher had access to existing survey data collected as part of a larger IMLS funded research project that sought to identify the effects of school librarians on student outcomes. This data allows the researcher to generalize results from the interviews to the broader population of New York State librarians.

Third, the researcher had access to potential participants. The researcher is well known throughout the state from her experience as a school librarian; is known for providing professional development opportunities on various school library and educational technology topics; and taught multiple courses in 1 of the 6 school library certification programs in the state.
This reputation provided the researcher access to school librarians and other school personnel in the state based on professional connections.

**Design**

**Data Set 1 - Survey**

The first data set is a survey. Surveys are appropriate for answering research questions that ask who, what, where, how many, and how much, focus on contemporary events, and do not require control over behavioral events (Yin, 2017, p. 9). Vogt & Johnson (2016) define a survey as “a research design in which a sample of subjects is drawn from a population and studied (e.g., via interviews or questionnaires) in order to make inferences about a population” (p. 439). Vogt & Johnson (2016), further define a questionnaire as “a self-reported data collection instrument, including a group of written items or questions to which subjects respond” (p. 358).

Utilizing a survey allowed the researcher to collect the views of school librarians from a larger number of schools than focus groups or case studies. Due to the variations in characteristics in schools throughout New York State (for example: urban, suburban, rural; available funding; demographic characteristics; grade levels served), a survey approach strengthens generalizability of the results of this research. A survey allowed the researcher to gather sufficient data to be able to represent all schools in the state, and to speak to maker programs throughout the state.

Originally designed to be disseminated independently, the survey was combined with the IMLS funded project\(^1\) survey so that researchers from both studies would not overwhelm the

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\(^1\) IMLS 2018-2021: RE-96-18-0032-18 Principal Investigator Joette Stefl-Mabry, PhD, Co-Investigator Dr. Michael Radlick “Seeking Stronger Evidence of School Library Effects on Student Outcomes,” sponsored by the Institute of Museum and Library Services, June 30, 2018 – June 30, 2021. This was a mixed methods study that explored how school librarians affect student outcomes.
same audience with requests for participation, particularly as recruitment coincided with the emergence of the COVID-19 health crisis.

Two open ended questions from the survey are used for this study:

Q17.2 What prompted you to create a makerspace or offer maker activities in the library?
Q17.9 What outcomes do you anticipate for students participating in makerspace activities in your library?

The survey instrument was pre-tested with a group of ten school librarians and school administrators within New York State for feedback before dissemination. Minor spelling and grammar changes were made based on feedback. The survey was reviewed and deemed exempt by the University at Albany Institutional Review Board.

Survey Sample Design

The target sample population was all public school librarians in New York State. The sampling for this survey was purposive, as it included those most able to speak to innovation in school libraries. Based on Basic Educational Data System (BEDS) data from 2017-2018, the anticipated sample frame was 2,950. A 10% response rate (295 respondents) was the goal, as previous research conducted with this audience had similar response rates.

Recruitment Strategies

Two recruitment strategies were used – direct emailing, and dissemination by School Library Systems directors. In all recruitment efforts a document was included that outlined the study, how the information would be used, the expected time commitment, the anticipated benefits for participating (Goldstein, 2002, p. 671), as well as indication of IRB exemption and contact information. Additional Recruitment information can be found in Appendix A. Informed consent can be found in Appendix B.
**Distribution and Response Rate**

The survey was distributed between April 7, 2020 and April 20, 2020 to all public school librarians in New York State with identifiable email addresses using Qualtrics. In total, 2,657 survey invitations were sent to valid email addresses of school librarians in 10 regions throughout New York State. Additionally, a generic invitation was sent for distribution to each of the BOCES SLS Directors, and the New York City Library System Coordinators to encourage participation from school librarians for whom no contact information was found. Respondents were sent two follow up emails with reminders to participate before the survey closed on May 31, 2020.

The survey closed on June 1, 2020 with a total of 890 surveys started, and 739 marked as complete. Of those 739 surveys, 709 (79.66%) unique respondents reported enough information to be linked with other data sets (building name or BEDS code). The overall completion rate for surveys sent was 28%, with the lowest response rate coming from Region 10 New York City (19%), and the highest response rates coming from Region 3 Southeastern New York (38%) and Region 5 Central New York (37%). Of the 709 usable responses, 671 individuals answered the questions regarding makerspaces, 584 of those responses were from librarians in schools outside of New York City.

**Representativeness of Survey Responses**

Nonresponse error occurs when “the characteristics of respondents differ from those who chose not to respond in a way that is relevant to the study results” (Dillman et al., 2014, p. 5). A representativeness analysis was performed to identify if responding school libraries differed from non-responding school libraries. Due to the low response rate from New York City school librarians, only the respondents from schools outside of New York State are included. A logistic
model was built that included the following demographic characteristics: pupil wealth ratio, local revenue effort, school enrollments, percentages of Black students, Hispanic students, White students, economically disadvantaged students, English language learners, whether the school had a full time or more school librarian, the New York State Need/Resource Index, school type, and geographic locale type. Table 3 contains the full results of this analysis.

**Table 3**

*Survey Representativeness Analysis*

<table>
<thead>
<tr>
<th>Logistic regression</th>
<th>Number of obs 2,265</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>LR chi2(19) 66.06</td>
</tr>
<tr>
<td></td>
<td>Prob &gt; chi2 0.000</td>
</tr>
<tr>
<td>Log likelihood</td>
<td>-1256.61</td>
</tr>
<tr>
<td></td>
<td>Pseudo R2 0.0256</td>
</tr>
</tbody>
</table>

| Survey_Response_Flag                  | Odds Ratio | Std. Err. | z       | P>|z|   | [95% Conf. Interval] |
|---------------------------------------|------------|-----------|---------|-------|---------------------|
| PupilWealthRatio1718                  | 0.97       | 0.04      | -0.78   | 0.438 | 0.90                | 1.05                |
| LocalRevenueEffort1718                | 0.99       | 0.01      | -0.59   | 0.553 | 0.97                | 1.01                |
| SchoolEnrollment1718                  | 1.00       | 0.00      | 2.87    | 0.004**| 1.00                | 1.00                |
| PercentEnglishLangLearners1718       | 0.99       | 0.01      | -0.76   | 0.446 | 0.97                | 1.01                |
| PercentBlackStudents1718             | 0.99       | 0.01      | -0.91   | 0.361 | 0.98                | 1.01                |
| PercentHispanicStudents1718          | 1.00       | 0.01      | 0       | 0.996 | 0.99                | 1.01                |
| PercentWhiteStudents1718             | 1.00       | 0.01      | 0.47    | 0.642 | 0.99                | 1.02                |
| PercentStudentsWDisabilities1718      | 0.99       | 0.01      | -0.75   | 0.456 | 0.97                | 1.01                |
| PercentEconomicDisadvantage1718      | 1.00       | 0.00      | -0.45   | 0.653 | 0.99                | 1.01                |
| FullTimeOrMoreLibrarian              | 1.86       | 0.28      | 4.09    | 0.000***| 1.38                | 2.51                |
| NeedIndex                            | 1.02       | 0.09      | 0.25    | 0.806 | 0.86                | 1.21                |

<table>
<thead>
<tr>
<th>SchoolType</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary&amp;Middle</td>
<td>0.76</td>
<td>0.12</td>
<td>-1.79</td>
<td>0.074</td>
<td>0.56</td>
<td>1.03</td>
</tr>
<tr>
<td>Middle</td>
<td>0.96</td>
<td>0.15</td>
<td>-0.27</td>
<td>0.786</td>
<td>0.70</td>
<td>1.31</td>
</tr>
<tr>
<td>Middle&amp;High</td>
<td>1.08</td>
<td>0.21</td>
<td>0.42</td>
<td>0.677</td>
<td>0.74</td>
<td>1.58</td>
</tr>
<tr>
<td>High</td>
<td>1.00</td>
<td>0.17</td>
<td>-0.03</td>
<td>0.979</td>
<td>0.72</td>
<td>1.39</td>
</tr>
<tr>
<td>PK-12</td>
<td>0.99</td>
<td>0.29</td>
<td>-0.03</td>
<td>0.976</td>
<td>0.56</td>
<td>1.77</td>
</tr>
</tbody>
</table>

| SORTNCES                              |            |           |         |       |                     |                    |
| Rural                                 | 0.49       | 0.13      | -2.6    | 0.009**| 0.29                | 0.84                |
The results indicate that there are no statistically significant differences between respondents and non-respondents in terms of pupil wealth ratio, local revenue effort, percentages of English language learners, Black students, Hispanic students, White students, economically disadvantaged students, the New York State Need/Resource Index, or school type. There were statistically significant differences between respondents and non-respondents in terms of school enrollment, whether the school had a full time or more school librarian, and geographic locale type. Specifically, there is slightly higher response rate from larger schools, and lower response rate from rural and suburban schools. There is a much higher response rate from schools with a full time or more school librarian than from those with less than a full-time school librarian.

In terms of maker programs, 68% of survey respondents indicate having a maker program in the form of either maker activities or a dedicated makerspace. Table 4 provides additional information about characteristics of survey respondents as compared to all schools outside of New York City in the state.

Table 4

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>School Library</th>
<th>Survey Respondents</th>
<th>Has Maker Program</th>
<th>No Maker Program</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>City</td>
<td>311</td>
<td>10.7</td>
<td>56</td>
<td>9.6</td>
</tr>
<tr>
<td>Suburban</td>
<td>1,497</td>
<td>51.6</td>
<td>296</td>
<td>50.7</td>
</tr>
<tr>
<td>Town</td>
<td>352</td>
<td>12.1</td>
<td>83</td>
<td>14.2</td>
</tr>
<tr>
<td>Rural</td>
<td>742</td>
<td>25.6</td>
<td>149</td>
<td>25.5</td>
</tr>
</tbody>
</table>

Note: * p<0.10, ** p<0.05, *** p<0.01
<table>
<thead>
<tr>
<th>Category</th>
<th>Obs</th>
<th>Mean</th>
<th>Obs</th>
<th>Mean</th>
<th>Obs</th>
<th>Mean</th>
<th>Obs</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupil Wealth Ratio</td>
<td>2,902</td>
<td>1.1</td>
<td>584</td>
<td>1.1</td>
<td>396</td>
<td>1.1</td>
<td>188</td>
<td>1.1</td>
</tr>
<tr>
<td>Local Revenue Effort</td>
<td>2,902</td>
<td>19.7</td>
<td>584</td>
<td>19.8</td>
<td>396</td>
<td>19.6</td>
<td>188</td>
<td>20.2</td>
</tr>
<tr>
<td>Enrollment</td>
<td>2,902</td>
<td>551.5</td>
<td>584</td>
<td>621.2</td>
<td>396</td>
<td>608.3</td>
<td>188</td>
<td>648.4</td>
</tr>
<tr>
<td>% Economic Disadvantage</td>
<td>2,902</td>
<td>46.5</td>
<td>584</td>
<td>42.5</td>
<td>396</td>
<td>41.9</td>
<td>188</td>
<td>43.8</td>
</tr>
<tr>
<td>% White Students</td>
<td>2,902</td>
<td>65.5</td>
<td>584</td>
<td>71.1</td>
<td>396</td>
<td>72.4</td>
<td>188</td>
<td>68.3</td>
</tr>
<tr>
<td>% Black Students</td>
<td>2,902</td>
<td>10.3</td>
<td>584</td>
<td>7.6</td>
<td>396</td>
<td>7.2</td>
<td>188</td>
<td>8.6</td>
</tr>
<tr>
<td>% Hispanic Students</td>
<td>2,902</td>
<td>15.5</td>
<td>584</td>
<td>12.7</td>
<td>396</td>
<td>12.3</td>
<td>188</td>
<td>13.5</td>
</tr>
<tr>
<td>% Multiracial or Other</td>
<td>2,902</td>
<td>8.3</td>
<td>584</td>
<td>8.5</td>
<td>396</td>
<td>8.0</td>
<td>188</td>
<td>9.5</td>
</tr>
<tr>
<td>% Students with Disabilities</td>
<td>2,902</td>
<td>15.6</td>
<td>584</td>
<td>14.7</td>
<td>396</td>
<td>14.7</td>
<td>188</td>
<td>14.7</td>
</tr>
<tr>
<td>% English Language Learners</td>
<td>2,902</td>
<td>5.3</td>
<td>584</td>
<td>4.1</td>
<td>396</td>
<td>3.8</td>
<td>188</td>
<td>4.7</td>
</tr>
</tbody>
</table>

*Note: This table shows the basic demographics of schools NYS outside of NYC in the 2017-2018 school year in comparison to the survey participants in this study. Percentages are based off total number in each category. For example, 10.7% of school libraries are located in cities.*

**Data Set 2 – Semi-Structured Interviews**

Data set 2 includes verbatim transcripts of interviews, video and audio recordings of the interviews, and researcher field notes taken at the time of the interviews, as well as during the analysis phase.
Cases were examined through semi-structured interviews of school librarians and other school personnel in schools where maker programs have been incorporated into the school library as Yin (2017, p. 12) indicates that interviews with individuals involved in the phenomena are important. Maxwell (2013) indicates that the use of interviews is particularly beneficial when exploring events that took place in the past. In-depth interviews are widely used for qualitative data collection as they are versatile, adaptable, and useful in uncovering information and understanding phenomena (Guest et al., 2013). Interviews are one-on-one, allowing the researcher to focus on the individual and their previous answers to adapt questions and probes as needed; they utilize open ended questions which allow for detailed and textured responses; they allow for inductive probing – asking questions based on interviewees previous responses while also linking to the research questions; and they look and feel like a conversation, which allows the researcher to build rapport with the interviewee (Guest et al., 2013).

Interviews are particularly useful in answering how and why questions, as they help “researchers to understand their interviewees’ views of processes, norms, decision making, belief systems, mental models, interpretations, motivations, expectations, hopes, and fears” (Guest et al., 2013, p. 118) and “they are especially useful for exploring and explaining phenomena” (p.119).

**Site Selection**

To provide a robust understanding of maker programs in school libraries in New York State the researcher used purposive sampling based on the results from the survey to identify sites to ensure maximum variability. Because maker programs vary widely from site to site, it was important to ensure that multiple configurations were included. At the same time, identifying cases with clearly differing contexts allowed for theoretical replication of findings.
(Yin, 2017, p. 55) and helped to identify if there are contextual factors that may explain conflicting findings.

Within the sites chosen, the following characteristics were used to identify potential cases:

1. year adopted maker program was created
2. grade levels served (elementary, elementary and middle, middle, middle and high, high school)
3. location (urban, suburban, rural; location throughout the state)
4. researcher access

Potential cases were excluded if the school librarian did not work in the building at the time the makerspace was established, if the school librarian that answered the survey had left the school, or if the school librarian answering the survey indicated they did not wish to be contacted for follow-up. Further, cases included only libraries outside of New York City.

First, survey respondents were filtered to identify cases to be excluded. Then, participants were categorized based on the year maker programs were established in the school library. Then, within each category of adopters, participants were separated based on grade levels served. Finally, potential cases were filtered based on geographic locale. Within each adopter category, an effort was made to identify a school with each grade level configuration, and each locale code. In total, 45 potential cases were identified.

**Participant Selection**

The case studies included two profiles of participants – school librarians who operate maker programs, as well as other educators that work in schools with library-based maker programs. Other educators included school and district level administrators to understand their
support of the school library program in general, and specifically maker programs in their libraries. Other school personnel interviewed included library clerks, teaching assistants, teachers, and technology integration specialists. When possible, snowball sampling was used to identify additional educators from the same school as the librarian participant who could shed light on the research questions being explored. Additionally, the researcher’s professional connections were used to ensure a balance of school librarian and other educator participants.

Interviewing the school librarian was important because they are often the individual deciding to implement innovations in their school libraries and are considered a key informant. Interviewing building and district administrators was important because they shape the culture of the school and district and were able to shed light on the supports in place for school librarians and their programs, as well as the culture of the school as a whole. Interviewing a teacher was beneficial because they interact with the school library, librarian, students, and maker program – and they are an important stakeholder that may adopt maker programs with their students, or for themselves. Interviewing a library clerk was beneficial because outside of the school librarian, they may have the most interactions with students, teachers, and the librarian in the library and makerspace.

A sample of 20 individuals had been the original goal. It was determined that two school librarians from each grade level configuration would provide insight into maker programs at all grade levels – providing diversity in the data. The original intent had been to interview other educators in the same schools, however due to non-response that was not possible. It was determined that 20 interviews was sufficient as both data and theoretical saturation were reached. Data saturation occurs when no new codes or sub codes emerge from the data (Saunders et al., 2018). The interviews conducted later in the collection period did not add additional themes
when coding (Saunders et al., 2018). Theoretical saturation occurs when the data collected sufficiently represents the constructs of the theory being examined (Saunders et al., 2018). It was determined that the data collected was sufficient to illustrate the theory being explored as the initial codes were constructed around the four types of consequences.

In total, semi-structured interviews were conducted with 20 individuals including 10 school librarians, and 10 other educators in schools where there is a makerspace in the school library. Participants have been assigned pseudonyms to preserve anonymity, with the first letter of their name assigned based on their job title. For school librarians serving more than one population, pseudonyms are based on the grade level of the maker program they are speaking about. Table 4 summarizes interview participants and their roles.

Table 4

Summary of Interview Participants

<table>
<thead>
<tr>
<th>Pseudonym</th>
<th>Role</th>
<th>Grade Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Librarians</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emma</td>
<td>Elementary Librarian</td>
<td>(K-2)</td>
</tr>
<tr>
<td>Emily</td>
<td>Elementary Librarian</td>
<td>(3-5)</td>
</tr>
<tr>
<td>Ivy</td>
<td>Elementary Librarian</td>
<td>(4-6)</td>
</tr>
<tr>
<td>Isabel</td>
<td>Elementary, Intermediate, and High School Librarian</td>
<td>(PreK-4, 5-8, 9-12)</td>
</tr>
<tr>
<td>Melanie</td>
<td>Middle and High School Librarian</td>
<td>(6-8, 9-12)</td>
</tr>
<tr>
<td>Maddie</td>
<td>Middle School Librarian</td>
<td>(6-8)</td>
</tr>
<tr>
<td>Jenn</td>
<td>Junior-Senior High School Librarian</td>
<td>(7-12)</td>
</tr>
<tr>
<td>Jess</td>
<td>Junior-Senior High School Librarian</td>
<td>(7-12)</td>
</tr>
<tr>
<td>Sophie</td>
<td>Senior High School Librarian</td>
<td>(9-12)</td>
</tr>
<tr>
<td>Sadie</td>
<td>Senior High School Librarian</td>
<td>(9-12)</td>
</tr>
<tr>
<td>Other Educators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cindy</td>
<td>Library Clerk and Library Intern</td>
<td>(3-5, 9-12)</td>
</tr>
<tr>
<td>Trinity</td>
<td>Technology Teaching Assistant</td>
<td>(9-12)</td>
</tr>
<tr>
<td>Matt</td>
<td>Math and Computer Science Teacher</td>
<td>(9-12)</td>
</tr>
<tr>
<td>Tony</td>
<td>Technology Integration Specialist</td>
<td>(District Level)</td>
</tr>
<tr>
<td>Patricia</td>
<td>High School Principal</td>
<td>(9-12)</td>
</tr>
</tbody>
</table>
In terms of school librarians, interviews were conducted with two librarians responsible for elementary students (Emily and Emma), two school librarians responsible for intermediate students (elementary and middle) Ivy and Isabel, two middle school librarians Maddie and Melanie, two librarians in junior-senior high configurations (middle and high) Jenn and Jess, and two senior high school librarians (Sophie and Sadie). One school librarian is responsible for two libraries across three schools – one library is shared between middle and high school. One school librarian is responsible for two libraries connected to each other that serve two schools - middle and high school. One librarian has moved into an administrative position, but is interviewed as a librarian.

Other educators interviewed include one library clerk who is also a school library intern (Cindy), one technology teaching assistant who is responsible for technology integration in the school and is stationed in the school library (Trinity), one high school math and computer science teacher (Matt), one technology integration specialist, responsible for technology integration throughout the district (Tony), one building principal who has experienced makerspaces in three different schools where she has worked (Patricia). Also interviewed were three directors of technology (Diane, Debbie, and Danielle), one assistant superintendent for curriculum and instruction (Ana), and one superintendent of schools (Sam). Three district level educators spoke about more than one school. All 10 school librarians are female. Of the other educators, three are male, and seven are female.
Participants in this study provide insight into 17 schools across 11 school districts with maker programs in their school libraries. Table 5 summarizes characteristics of schools represented in the interviews.

**Table 5**

*Characteristics of Schools Represented in Interviews*

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>School Library</th>
<th>Interview Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>%</td>
</tr>
<tr>
<td>City</td>
<td>311</td>
<td>10.7</td>
</tr>
<tr>
<td>Suburban</td>
<td>1,497</td>
<td>51.6</td>
</tr>
<tr>
<td>Town</td>
<td>352</td>
<td>12.1</td>
</tr>
<tr>
<td>Rural</td>
<td>742</td>
<td>25.6</td>
</tr>
<tr>
<td>Large City</td>
<td>180</td>
<td>6.2</td>
</tr>
<tr>
<td>High Need/Urban-Suburban</td>
<td>320</td>
<td>11.0</td>
</tr>
<tr>
<td>High Need Rural</td>
<td>377</td>
<td>13.0</td>
</tr>
<tr>
<td>Average Need</td>
<td>1,372</td>
<td>47.3</td>
</tr>
<tr>
<td>Low Need</td>
<td>598</td>
<td>20.6</td>
</tr>
<tr>
<td>Charter</td>
<td>54</td>
<td>1.9</td>
</tr>
<tr>
<td>Elementary</td>
<td>1178</td>
<td>40.6</td>
</tr>
<tr>
<td>Elementary &amp; Middle</td>
<td>584</td>
<td>20.1</td>
</tr>
<tr>
<td>Middle</td>
<td>349</td>
<td>12.0</td>
</tr>
<tr>
<td>Middle &amp; High</td>
<td>235</td>
<td>8.1</td>
</tr>
<tr>
<td>High</td>
<td>443</td>
<td>15.3</td>
</tr>
<tr>
<td>PreK-12</td>
<td>113</td>
<td>3.9</td>
</tr>
<tr>
<td>Total</td>
<td>2,901</td>
<td></td>
</tr>
</tbody>
</table>

**Mean Comparison**

<table>
<thead>
<tr>
<th></th>
<th>Obs</th>
<th>Mean</th>
<th>Obs</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pupil Wealth Ratio</td>
<td>2,902</td>
<td>1.1</td>
<td>17</td>
<td>1.2</td>
</tr>
<tr>
<td>Local Revenue Effort</td>
<td>2,902</td>
<td>19.7</td>
<td>17</td>
<td>20.5</td>
</tr>
<tr>
<td>Enrollment</td>
<td>2,902</td>
<td>551.5</td>
<td>17</td>
<td>861.6</td>
</tr>
<tr>
<td>% Economic Disadvantage</td>
<td>2,902</td>
<td>46.5</td>
<td>17</td>
<td>38.9</td>
</tr>
<tr>
<td>% White Students</td>
<td>2,902</td>
<td>65.5</td>
<td>17</td>
<td>68.1</td>
</tr>
<tr>
<td>% Black Students</td>
<td>2,902</td>
<td>10.3</td>
<td>17</td>
<td>5.5</td>
</tr>
<tr>
<td>% Hispanic Students</td>
<td>2,902</td>
<td>15.5</td>
<td>17</td>
<td>20</td>
</tr>
<tr>
<td>% Multiracial or Other</td>
<td>2,902</td>
<td>8.3</td>
<td>17</td>
<td>6.4</td>
</tr>
<tr>
<td>% Students with Disabilities</td>
<td>2,902</td>
<td>15.6</td>
<td>17</td>
<td>14.5</td>
</tr>
<tr>
<td>% English Language Learners</td>
<td>2,902</td>
<td>5.3</td>
<td>17</td>
<td>4</td>
</tr>
</tbody>
</table>
Note: This table shows the basic demographics of schools represented in the interviews compares to all schools in the state outside of New York City. Percentages are based off total number in each category.

Of the schools, ten are located in suburban areas, and seven are located in rural areas. An attempt was made to include participants from areas considered cities, however requests went unanswered. Fifteen schools are considered average needs, two are considered low need based on the New York State Need/Resource Index. Again, attempts were made to include schools identified as high need, however requests went unanswered. In terms of school enrollment, five schools serve less than 500 students, seven serve between 500-1000 students, and five serve more than 1,000 students. Dedicated makerspaces were established in these school libraries between 2013 and the 2021-2022 school year. Two school libraries established dedicated makerspaces in the 2021-2022 school year, although one offered maker activities before that time.

Recruitment Strategies

Recruitment was done through direct emailing of potential participants. The email included a brief overview of the study, how the information would be used, the expected time commitment, the anticipated benefits for participating (Goldstein, 2002, p. 671), as well as indication of IRB approval and contact information (see Appendix C). The recruitment period lasted from January 29, 2022 through May 31, 2022.

An email invitation was sent to school librarians identified as potential participants. After two weeks, if the email had not been answered, a reminder email was sent with the same information with a request to participate. Contact information was obtained by reviewing New York State School Library Systems member directories posted publicly on the internet, and
through school district and building websites, which also post them publicly on the internet, as well as using the researcher’s professional contacts.

If a librarian agreed to participate, an email invitation was sent to the individual identified by the school librarian as a potential other educator participant. After two weeks, if the email was not answered, a reminder email was sent with the same information with a request to participate. If after two weeks the invitation remained unanswered, the school librarian was asked to identify another individual that may be willing to participate. Contact information was obtained from the school librarian, or from the school district website. When recruitment of other educators in the same school was not successful, the researchers relied on professional connections with administrators and other educators to ensure the sample size of the two profiles of participants was equal.

**Protocol**

A full interview protocol was developed for the participants (see Appendix E). Topics explored were in line with the research questions, and included:

- Background of the maker program in the school library
- Benefits of the maker program in the school library
- Costs of the maker program in the school library
- Risks of the maker program in the school library
- Challenges of the maker program in the school library
- Consequences of the maker program in the school library

All interviews were conducted remotely and recorded using the University at Albany Zoom platform and lasted no more than one hour per participant. Each interview was viewed, and corrections were made to the Zoom generated transcript.
Data Analysis

All interviews were recorded, transcribed, and hand-coded line-by-line by the author of this dissertation to ensure consistency (Saldaña, 2015). Before coding began, all identifying information was removed. Coding was done manually using Microsoft Word and Microsoft Excel. All data was coded using directed content analysis, which “is appropriate when using existing knowledge or theory to build the initial coding structure” (Hsieh & Shannon, 2018, p. 393). After the initial coding scheme is developed, the data is used to modify or expand the codes (Hsieh & Shannon, 2018, p. 393).

All data was read once to get an overall understanding. Data was read a second time and the initial set of codes derived from the analytical framework described in Chapter 3 were applied. At this stage, subcodes based on emerging themes were identified. Data was read a third time, and sub codes were applied. A code book was created that contains the names and definitions of the codes, as well as examples of each code (Table 6).

Table 6

Code Book

<table>
<thead>
<tr>
<th>Code</th>
<th>Operationalization</th>
<th>Illustrative Quotes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Decision Type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Optional</td>
<td>Indication that the individual made the decision</td>
<td>“It is something I really wish I would have had access to while I was in school and something I really, really felt my students in particular very much needed.”</td>
</tr>
<tr>
<td>Collective</td>
<td>Indication that the individual made the decision with someone else</td>
<td>“Collaboration with sixth grade science teacher”</td>
</tr>
<tr>
<td>Authority</td>
<td>Indication that someone in power made the decision</td>
<td>“Before my tenure, there was a makerspace in my school. It is attached to the library but run by an art teacher who was”</td>
</tr>
<tr>
<td>Contingent</td>
<td>Indication that one person made the decision and another person followed. This may be librarian then administrator, or previous librarian (space already existed), or indication that it was expected but the librarian also wanted to adopt</td>
<td>“Expectation when hired and my own passion”</td>
</tr>
<tr>
<td>------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
<td>------------------------------------------</td>
</tr>
<tr>
<td>Perceived Characteristics</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Relative Advantage</td>
<td>“the degree to which an innovation is perceived as being better than the idea it supersedes” (Rogers, 2003, p. 229). Advantage may be related to cost, time, social prestige</td>
<td>“Give students access to tools and projects they would not otherwise have.”</td>
</tr>
<tr>
<td>Compatibility</td>
<td>“is the degree to which an innovation is perceived as consistent with existing values, past experiences, and needs of potential adopters” (Rogers, 2003, pp. 15, 224, 473)</td>
<td>“it aligns with my philosophy of how kids learn best.”</td>
</tr>
<tr>
<td>Complexity</td>
<td>“the degree to which an innovation is perceived as relatively difficult to understand and use” (Rogers, 2003, p. 16). Related to existing skills, existing knowledge</td>
<td>“I could not wrap my head around makerspace. I didn't see how it had anything to do with what I did in the library, that it would be distracting to my curriculum.”</td>
</tr>
<tr>
<td>Observability</td>
<td>“The degree to which the results of an innovation are visible to others” (Rogers, 2003, p. 475)</td>
<td>“Communication with other school librarians.”</td>
</tr>
<tr>
<td>Trialability</td>
<td>“the degree to which an innovation can be experimented with on a limited basis” (Rogers, 2003, p. 258)</td>
<td>“We had these materials available from our BOCES, so I decided to try using them.”</td>
</tr>
<tr>
<td>Consequences</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anticipated Consequences</td>
<td>“are changes due to an innovation that are recognized and intended by members of the social system” (Rogers, 2003, p. 448)</td>
<td>“Students will see the library as a safe and creative place for learning all types of new things.”</td>
</tr>
<tr>
<td>Unanticipated Consequences</td>
<td>“are changes due to an innovation that are neither intended nor recognized by members of the social system” (Rogers, 2003, p. 448)</td>
<td>“Collaboration and working as a team. That is a big thing, and I guess I hadn’t realized how big that was when we started.”</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>-------------------------------------------------------------------------------------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Desirable Consequences</td>
<td>“the functional effects of an innovation for an individual or for a social system” (Rogers, 2003, p. 442).</td>
<td>“there's this buzz of energy and excitement of in the library space, kids are very happy to be there, and there's such a difference. When I first started, the libraries were so quiet.”</td>
</tr>
<tr>
<td>Undesirable Consequences</td>
<td>“the dysfunctional effects of an innovation to an individual or to a social system” (Rogers, 2003, p. 442).</td>
<td>“I honestly think that putting the responsibility of maintaining and running that makerspace on the librarian is a huge undertaking. They have so many things on their plates between all the other things that go into a library media center.”</td>
</tr>
</tbody>
</table>

Sub Codes/Themes

<table>
<thead>
<tr>
<th>Previously held beliefs</th>
<th>“… it aligns with my philosophy of how kids learn best.”</th>
</tr>
</thead>
<tbody>
<tr>
<td>Felt needs/problems</td>
<td>something an individual or organization feels needs to change or be solved</td>
</tr>
<tr>
<td></td>
<td>“Students don't have many opportunities to use their hands, create freely, express themselves”</td>
</tr>
<tr>
<td>Change Perceptions - Library</td>
<td>See or use the library in a different manner</td>
</tr>
<tr>
<td>Change Perceptions – School/Learning</td>
<td>See the school or learning in a different manner</td>
</tr>
<tr>
<td>Support – Improve Resource</td>
<td>May include time, space, materials</td>
</tr>
<tr>
<td>Access/Utilization</td>
<td>“a change in perspective about what the library offers”</td>
</tr>
<tr>
<td>Support - General Learning/curriculum</td>
<td>May include general or subject area specific</td>
</tr>
<tr>
<td></td>
<td>“I think makerspaces allow us to do that to kind of re-conceive of the possibilities and what can make for a good education.”</td>
</tr>
<tr>
<td>Support - STEM/STEAM</td>
<td>Mentions content area or content in general</td>
</tr>
<tr>
<td></td>
<td>“connection between STEAM curriculum and our inquiry process”</td>
</tr>
<tr>
<td>Support - Improved relationships</td>
<td>Positive relationships lead to knowing students better</td>
</tr>
<tr>
<td>---------------------------------</td>
<td>------------------------------------------------------</td>
</tr>
<tr>
<td>Support – Increased Collaboration</td>
<td>Notes new collaboration with teachers</td>
</tr>
<tr>
<td>Improved Climate</td>
<td>A change in how individual feel/the collective mood of the school library</td>
</tr>
<tr>
<td>Increased usage</td>
<td>More or different students/teachers using the library and its resources</td>
</tr>
<tr>
<td>Changing attitudes/beliefs</td>
<td>Participants mentions changing attitudes or beliefs</td>
</tr>
<tr>
<td>Change Agents</td>
<td>Participant notes another individual adopted as a result or they taught others about makerspaces</td>
</tr>
<tr>
<td>Increased workload</td>
<td>See Also: Obtaining Materials Manage and Maintain Materials Renovating/modifying the library Training Designing and Implementing Activities</td>
</tr>
</tbody>
</table>
| Changing financial costs | See Also:  
| Obtain Materials  
| Manage and Maintain Materials  
| Renovating /modifying the library  
| Training  
| Designing and Implementing Activities  
| School/District Librarian  
| Other  |
| Changing financial costs | “she did a lot of the purchasing and worked with our business official to find grants and funding sources for the library” |

| Risks | “I think the biggest thing is money spent that you might not see right away that students are utilizing it.”  
| Obtaining materials | “I actually obtained most of the product, we have in the makerspace through grants” |
| Managing and Maintaining Materials and Equipment | “makerspaces can be kind of messy and when you're trying to maintain a like clean environment...”  
| Renovating /modifying the library | “I did a renovation in my library with makerspace in mind… it was through a grant one of our education grants that's funded right within the district”  
| Designing and Implementing Activities | “my library clerk, she's often setting and resetting the space all the time.”  
| Training | “the librarian really needs to have that background in how to operationalize it, and how to how to sort of make it work.”

Subcodes:

- Grants  
- Donations  
- Budget  
- Cost to librarian  
- Furniture
<table>
<thead>
<tr>
<th>Disappointed students</th>
<th>“We had to limit the amount of lunch passes they could have which they would get upset over.”</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Social Emotional Outcomes</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Self-Awareness</strong></td>
<td>“The abilities to understand one’s own emotions, thoughts, and values and how they influence behavior across contexts. This includes capacities to recognize one’s strengths and limitations with a well-grounded sense of confidence and purpose.”</td>
</tr>
<tr>
<td></td>
<td>(Collaborative for Academic Social and Emotional Learning, 2020)</td>
</tr>
<tr>
<td><strong>Self-Management</strong></td>
<td>“The abilities to manage one’s emotions, thoughts, and behaviors effectively in different situations and to achieve goals and aspirations. This includes the capacities to delay gratification, manage stress, and feel motivation &amp; agency to accomplish personal/collective goals.”</td>
</tr>
<tr>
<td></td>
<td>(Collaborative for Academic Social and Emotional Learning, 2020)</td>
</tr>
<tr>
<td><strong>Social Awareness</strong></td>
<td>“[students have] come to expect that these things are available. … Resource availability has improved and they understand that.”</td>
</tr>
<tr>
<td></td>
<td>(Collaborative for Academic Social and Emotional Learning, 2020)</td>
</tr>
<tr>
<td>Relationship skills</td>
<td>“The abilities to establish and maintain healthy and supportive relationships and to effectively navigate settings with diverse individuals and groups. This includes the capacities to communicate clearly, listen actively, cooperate, work collaboratively to problem solve and negotiate conflict constructively, navigate settings with differing social and cultural demands and opportunities, provide leadership, and seek or offer help when needed.” (Collaborative for Academic Social and Emotional Learning, 2020)</td>
</tr>
<tr>
<td>---------------------</td>
<td>--------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Responsible decision making</td>
<td>“The abilities to make caring and constructive choices about personal behavior and social interactions across diverse situations. This includes the capacities to consider ethical standards and safety concerns, and to evaluate the benefits and consequences of various actions for personal, social, and collective well-being.” (Collaborative for Academic Social and Emotional Learning, 2020)</td>
</tr>
</tbody>
</table>

A second PhD candidate coded 10% of each of the open-ended responses, and two interviews for each type of participant (four interviews in total) to check for researcher bias. The second coder was trained in one training session to explain the code book, and the underlying theory being used. The second coder was provided with a simple random sample of 10% of the survey responses for each of the questions, and two interviews from each type of participant. Because the risks and ethical concerns related to this project were assessed as negligible, a
percentage agreement method (Nili et al., 2020) was used to assess intercoder reliability. Initial coding resulted in a 64% match for one survey question, and a 52% match for the second. The researcher and second coder met to discuss any discrepancies and clarify codes and definitions. All disagreement revolved around the difference between relative advantage, and compatibility with felt needs or problems. It was determined that the two constructs were indistinguishable in this context – as the relative advantage was often in relation to providing something that was missing from the students’ education, and that for each participant, these constructs may mean different things. The responses were then coded a fourth, and final time to ensure that responses that could be identified as both were coded as both. Regarding the interviews, the code book had already been adjusted, and there was 100% agreement on the codes.

**Ethical Considerations**

Prior to conducting the study, this research was reviewed by the Institutional Review Board at the University at Albany. Approval from all survey participants was sought when the survey was conducted (Appendix A), and an informed consent statement was provided (Appendix B). Participants were notified they could leave the survey or skip any question at any time. Approval from all interview participants was sought prior to scheduling interviews, as well as at the beginning of the interviews. Informed consent for participation, as well as notification of audio and video recording was provided to each participant (Appendix D). In both data collection efforts, during the informed consent process, the researcher clearly laid out the intent of the study, exactly what was expected of each participant, as well as potential harm and benefits the study may cause. Participants in both collection efforts were notified they could choose not to answer any questions and refuse to complete any portions of the research they did not wish to for any reason. There were no direct benefits to participants of the study, however
there is a potential benefit to educators and other researchers in developing a deeper understanding of implementing maker programs in school settings. During data collection the researcher avoided leading questions. All interview participants gave explicit permission for audio and video recording, none withdrew during or after the interview.

No information about respondents, their school, or their answers will be released in any manner that would tie the responses to them. All reports, papers and articles will include pseudonyms for the participants as well as the schools, and no personally identifying information will be included. Participation in each phase of the research was voluntary, and all participants could withdraw at any time, for any reason.

Data and materials are stored in secure locations, including the researcher’s password protected personal computer, as well as in the researcher's password protected OneDrive account (in the event that something happens to the researcher’s computer). Raw data will only be available to the researcher conducting the study, and the supporting faculty members. Prior to data analysis, all names and identifying information were removed. Each participant and document was assigned a reference number. This reference number and what it attaches to will be kept in a separate password protected document, in a separate password protected storage system than the data files. Personally identifiable information will only be stored on the researcher’s password protected computer, separate from other data files. It will never be stored online.
Chapter 4: Results

Research question is: **R1. What drives the adoption of maker programs in school libraries?**

The qualitative data from the survey as well as the responses from the interviewees indicate that there are two main drivers of maker program adoption in school libraries. First, school librarians are key players in the decision to adopt, and drive maker program adoption in their schools based on their beliefs and perceptions of the benefits of maker programs related to relative advantage and compatibility with felt needs or problems. Second, the observability of the results of maker program implementation related to both trialability before full adoption and visibility in communication channels drove school librarians to adopt in hope of realizing the same results for their schools.

Research question is: **R2. What are the consequences of implementing maker programs in school libraries?**

The interview data reveals a multitude of consequences from implementing maker programs in school libraries. First, the data reveals five main desirable consequences of implementing maker programs: 1) changing perceptions of the school library, 2) changing perceptions of school and learning, 3) increased library usage, 4) increased support for student learning, and 5) improved social emotional skills for students.

Second, the data reveals two main unanticipated consequences from implementing maker programs among participants in this study: 1) a change in attitudes and beliefs of school librarians and administrators, and 2) school librarians have become change agents in their schools and districts, as well as in the wider community.
Third, the data reveals three main undesirable consequences of maker program adoption. Implementing a maker program results in 1) increased workload for school librarians and other members of the social system, 2) changing financial costs to the school and the librarian, and 3) increased risk.

**Key Decision Makers**

Table 7 summarizes who made the decision to adopt a maker program in the school library. Of participants, a vast majority indicate the decision to create the makerspace was optional — that the school librarian made the decision to adopt based on their beliefs — the perceived characteristics of the innovation. For example, one respondent said, “I wanted students to become a stakeholder in our space and give them more ownership of their learning and time in the room.” Similarly, another said “I felt strongly that libraries were meant to provide opportunities to learn and create in a variety of realms; not just literary and I also knew that many students benefit from doing and making things.”

**Table 7**

*Innovation Decision Type for Maker Program Adoption*

<table>
<thead>
<tr>
<th>Decision Type</th>
<th>Example</th>
<th>Survey</th>
<th></th>
<th>Interviews</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Optional</td>
<td>“I wanted a place for students to be curious, creative, collaborative and challenge themselves.”</td>
<td>317</td>
<td>87</td>
<td>12</td>
<td>60</td>
</tr>
<tr>
<td>Contingent</td>
<td>“It was here when I came; I simply expanded the physical space and added more materials.”</td>
<td>23</td>
<td>6</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Collective</td>
<td>“collegial decision with district librarians”</td>
<td>12</td>
<td>3</td>
<td>5</td>
<td>25</td>
</tr>
<tr>
<td>Authority</td>
<td>“Told to do so”</td>
<td>15</td>
<td>4</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total Responses</td>
<td></td>
<td>366</td>
<td>100</td>
<td>20</td>
<td>100</td>
</tr>
</tbody>
</table>

*Note: This table represents who made the decision to adopt a maker program in the school library.*
Some indicate that the decision was contingent – one individual made the decision to adopt, and then another followed. In most of these cases the makerspace existed before the librarian was hired, in some it is noted that it was requested or suggested, but not required by administration. In each of these cases the librarian indicated they too were interested in creating a makerspace. For example, one participant says, “It was started before I came to my school…I have chosen to make Makerspace an important part of my library” and another says it was an “expectation when hired and my own passion.”

Some indicated that the decision was collective – that the school librarian decided to adopt collaboratively with someone else. For example, one participant said, “After our library renovation admin and I together decided to do this.” Other educators involved in collective decisions include other librarians in the school district, building and school district administrators, and STEM related teachers. In some cases, it was indicated that this was a school or district wide initiative.

A minority indicate that the decision was an authority decision – that the individual deciding to adopt was not the school librarian. In most cases the makerspace was decided on by administration, in two cases it was another teacher. One participant noted “I had to. Had no other choice.” A second says “my district has created four such spaces (in each of the secondary schools), but the LMSs are not permitted to run them. The space that is maintained within MY library is run by a teaching assistant.”

Rogers’ theory states that how a potential adopter perceives an innovation influences the decision to adopt or reject it. As a vast majority of school librarians indicate they were either the sole decision maker, or part of a collective or contingent decision, their beliefs about maker programs help uncover what drives maker program adoption.
**Drivers**

**Perceived Attributes**

Rogers notes “[i]n certain diffusion studies…. relative advantage and compatibility were found not to be empirically distinct, although they are conceptually distinct” (p. 249). Although theoretically relative advantage and compatibility should be separate, after analysis it became clear that these concepts are not able to be separated because for each participant they may mean a different thing. At the same time, participants’ beliefs regarding the relative advantage and compatibility of maker programs are difficult to separate because felt needs or problems are often expressed as what students do not have access to in traditional classrooms and libraries. Felt needs or problems identified by participants include a) lack of similar opportunities in other parts of the school, b) a need for stress-relief for students, c) a break from regular academics, d) a safe space, e) opportunities for creativity, hands on activities, and development of skills for future careers and interests. Still others are f) attempting to address behavioral problems with students, and g) to involve students more in the library space.

Participants view maker programs as having relative advantage over traditional forms of teaching and learning with the potential to increase student engagement in learning and the library and increase the social prestige of the library media center in the eyes of the community. Participants believe maker programs are compatible with felt needs or problems within the school or library, existing values, beliefs, and past experiences, and existing curriculum and styles of teaching. For most participants, it was a combination of the perceived attributes of maker programs that prompted them to start one in the library.
Beliefs and Perceptions

Participants’ beliefs regarding the potential benefits of maker programs is the most prominent driver of adoption. Participants in this study believed that maker programs will lead to 1) increases in students’ social emotional skills including self-awareness, self-management, relationship, responsible decision-making, and social awareness skills. Participants believed implementing a maker program would 2) change how members of the social system viewed the school library. This change in perception would allow the librarian to 3) support student learning in three ways: a) through improved resource access and utilization – time, space, and materials - by the whole school community; b) by supporting and supplementing what happens in the traditional classroom curriculum; and c) by providing opportunities for students to experience learning in different ways.

Improved Social Emotional Skills

Overwhelmingly respondents in both the survey and interviews referred to social and emotional skills when anticipating outcomes from maker program implementation. Therefore, the Collaborative for Academic, Social, and Emotional Learning (CASEL) Framework for Social Emotional Learning was used to categorize the outcomes school librarians expected for students when incorporating maker programs. The CASEL Framework identifies 5 areas for social and emotional competence: self-awareness, self-management, social awareness, relationship skills, and responsible decision making (Collaborative for Academic Social and Emotional Learning, 2020). A summary of results can be found in Table 8.

Table 8

Summary of Anticipated Social Emotional Outcomes from Maker Activities

<table>
<thead>
<tr>
<th>SEL Construct</th>
<th>Example</th>
<th>Survey</th>
<th>Interviews</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Librarian</td>
</tr>
</tbody>
</table>

67
A vast majority of participants anticipated at least one social emotional outcome from participation in maker programs, a majority anticipated more than one, and many anticipated skills from more than one category. For example, one survey participant says

It is an area of need for my primary-aged students. They come with too much experience sitting and consuming tv/movies/video games, and not enough time spent cutting, gluing, playing with play-doh, drawing, crafting, etc. Most students are used to projects being fed to them, step-by-step, and struggle with the idea of experimentation. The fine-motor skills involved in hands-on making are important for their development, but even more so, my kids need the experiences of persevering; trying something different when the first idea doesn't work; communicating their goals to another person; compromising and
working together with others; speaking and listening to others when sharing about maker creations.

Participants indicate they implemented maker programs because they would allow students to develop social emotional skills as they engaged in fun, creative, problem-solving activities while touching on math, science, and technology skills.

The most commonly anticipated social emotional outcome for school librarians and other educators was improvement in students’ self-awareness by allowing them to identify personal assets, develop personal and academic interests, experience self-efficacy, and become independent learners with a growth mindset. The second most commonly anticipated social emotional outcome was that students would develop responsible decision making skills by thinking critically and identifying solutions to problems. The third most commonly anticipated social emotional outcome for school librarians and other educators was that students would develop relationship skills by socializing and collaborating. Some school librarians anticipated students would improve self-management by identifying and using stress management strategies and exhibiting self-discipline and self-motivation. Self-management was not mentioned by other educators in the school. Interview participants, especially other educators, anticipated growth in students’ and teachers’ social awareness as they recognized the resources and opportunities available in the school library. This was mentioned by only a handful of survey participants. The following subsections provide details of these findings.

**Self-Awareness.** Self-awareness competencies include self-efficacy, having a growth mindset, integrating personal and social identities, developing interests and a sense of purpose, identifying personal, cultural, and linguistic assets, identifying one’s emotions, demonstrating
honesty and integrity, linking feelings, values, and thoughts, and examining prejudices and biases (Collaborative for Academic Social and Emotional Learning, 2020).

These competencies are anticipated by more than half of participants. Survey respondents indicated that they wanted students to “learn something new about themselves as learners,” “have students bolster their self-esteem and build self-confidence,” and “understanding [their] own strengths and weaknesses.” One respondent notes they want students to gain “resilience, growth mindset, pride, enjoyment of school - as well as showing what content they've learned through making something that shows what they know, engineering practices, perseverance - on, and on, and on!” A second respondent states they want students to “become creators, develop grit, learn to push through failure, learn to integrate others' ideas, have fun.”

Similarly, interview participants expected that developing maker programs would improve student self-awareness by developing personal and academic interests, identifying personal assets, experiencing self-efficacy, and becoming independent learners with a growth mindset. One of Sophie’s purposes for creating a makerspace was “to encourage some independent inquiry, exploration based on whatever their interests were.” She notes:

Students often benefit from independent type inquiry, where they have an interest, they choose what they're doing, and they can take it wherever they want to take it. So yes, we're in an academic setting. Yes, we're in the school library. Yes, it's during school hours, but they're getting to choose what they want to do there, and then they can abandon if it's not working the way they want it to work, and if it's not something that they're really super interested in, they can find something else that they might be interested in. So the benefits, I think, are self-guided, self-directed inquiry that can
continue if they desire. It was just something that I wanted them to really embrace on their own, not necessarily having been assigned from class.

Similarly, Isabel wanted “to get back to centers-based learning to allow students to explore personal interests,” and Diane also notes a “need for more student engagement and reaching them through personal interests.” Matt says, “I really look at it as a not just a creative outlet for students, but a way for schools to help their students decide where they want to go. I feel like spaces like this allow them to creatively, and with minimal risk, explore other options of what they might love that they might overlook.” Exploration of interests may lead students to identify and build on their personal assets, develop a sense of purpose, and potentially discover new interests.

Self-efficacy is the belief in one’s ability to do something. Participants use descriptors such as “sense of pride,” “confident,” “validation,” “success,” “accomplishment,” and others to describe the anticipated benefits of maker programs. Emma recounts attending a professional development event that changed her attitude toward makerspaces. “The thing that hit me the most was one of the instructors said seeing some of her students that didn't connect in other places, or felt like maybe they weren't successful other places, were suddenly successful in the makerspace” and she wanted the same benefit for her students. Ivy notes “I wanted for kids to feel like ‘I did that!’” Matt says “I think spaces like this will give those kids that that feeling of ‘I can make something.’” Patricia says it’s “about students finding validation in creation.”

Maddie anticipated that the makerspace would allow students to be independent learners and develop a growth mindset:

I wanted students to learn troubleshooting techniques, by creating something, failing and trying again. I wanted them to learn how to follow instructions, teaching themselves how
to use these materials and not necessarily me being like the sage on the stage. I wasn't there to instruct them on how to use the makerspace, I wanted them to figure it out on their own.

Similarly, Matt believes maker programs will allow students to experience failure in a positive manner, and notes:

They need to see that now, where the consequences of that failure are not catastrophic. High school is the perfect place to fail. If you fail at something [in high school] it's not the end of the world. It doesn't mean you're going to lose your job. It doesn't mean you're going to be out on the street or anything like that. You learn to cope with it now, and deal with it, and how to recover from it.

**Responsible Decision Making.** Nearly one half of survey respondents identify responsible decision making competencies such as demonstrating curiosity and open-mindedness, identifying solutions for personal and social problems, learning to make a reasoned judgment after analyzing information, data and facts, anticipating and evaluating the consequences of one’s actions, recognizing how critical thinking skills are useful both inside and outside of school, reflecting on one’s roles to promote personal, family, and community well-being, and evaluating personal, interpersonal, community, and institutional impacts. Curiosity and problem solving are recurrent themes in many responses, for example “to learn to be curious about things and want to satiate the curiosity,” and “enhanced curiosity about life.” One respondent states “they will be curious learners, who will learn to work with others and apply knowledge to the world around them and the community.” A fourth notes “I hope they learn the power of their questions and develop a wide range of practices to help them investigate, create, and design answers for their questions.” This notion that the questions or problems being solved
should be of importance to the students is evident in other responses as well, such as “solving problems they are feel [are] important.”

Similarly, interview participants hope students will demonstrate curiosity and open-mindedness by creating and being creative, problem-solving, and thinking outside of the box, while also having fun – something some participants believe is missing in the traditional classroom. Ivy said:

I really got fascinated by that idea of exposing kids to the opportunity to make things rather than just being consumers of things, so they understand how everything that they consume and interact with was crafted. I wanted to give kids an opportunity to make rather than consume. To be active rather than passive in their interactions in the library.

Jess said she wanted
to get kids engaged, to create, and to learn to think outside the box. ‘Here are all of these things that you're given, what can you do with it?’ So to encourage creativity, encourage making - they don't do this in classrooms.

Similarly, Maddie states:

I wanted to encourage their creativity; they weren't very creative throughout the day. They were academic. They were in their classes; they were doing what they had to do. In the library they had a choice. They could do whatever they wanted to do with the materials, there were no rules on how to use the materials so if they saw a robot and wanted to do something entirely different with it, as long as they weren’t breaking it, they could go ahead and do that. There weren't, it's not like you have to use this in this way.

Other educators also see the potential of makerspaces to encourage creativity, problem solving, and critical thinking. Trinity notes “I think that the [anticipated] benefits were for people to have
a place to use their creativity.” Diane anticipates students will work through “the design process, and engineering process, working through iterations and problem solving.” Ana notes anticipating the makerspace would lead to “creative problem solving, thinking.”

**Relationship Skills.** Relationship skills include communicating effectively, developing positive relationships, demonstrating cultural competency, practicing teamwork and collaborative problem solving, resolving conflicts constructively, resisting negative social pressure, showing leadership in groups, seeking and offering support and help when needed, and standing up for the rights of others.

Such competencies are evident in almost one third of survey responses. One respondent indicates they anticipate students will gain “social interaction, learning to ask for and take advantage of help.” A second respondent echoes this theme of asking for and offering help “co-teaching among students, stronger students assisting those struggling,” while a third hopes students will learn to “take advice from peers.” There were also several participants who anticipate relationship development such as “connections made with me and other students/teachers,” “having students learning from peers.... having teachers learn from students,” and a third who notes “student interaction with peers they may not otherwise speak with during the day as well as interactions with teachers who also use the space for a mind-break.” Still others more broadly describe relationship skills such as “...communication, collaboration, teamwork, problem solving, etc.” and “general socialization and cooperation.”

Similarly, interview participants anticipate that creating makerspaces and offering maker activities will foster relationship skills. One of the reasons Jenn decided to create a makerspace was to address what she felt was a problem in her school – a lack of socialization.
My first year with high schoolers I saw the kids were just in study hall. Nobody talked to each other, nobody even talked to me, nobody did anything. They were just on their phones. [I thought] this is a way to initiate not only problem solving, critical thinking, but like talking to each other. Socialization was really a big part of it.

Similarly, Patricia explains “we're working together to create the space to be a more social space where students can participate and collaborate.” Sadie described wanting to provide “something that was very fun and collaborative that the students could do ... so I thought that that was going to be a goal - just have kids have some fun, collaborate, and learn maybe some science and problem-solving skills along the way.” Ana believed makerspaces would promote “teamwork and interacting with others,” and Diane describes anticipating that makerspaces will “really push the boundaries for collaboration and communication.”

**Self-Management.** Self-management includes competencies such as managing emotions, identifying and using stress-management strategies, exhibiting self-discipline and self-motivation, setting personal and collective goals, using planning and organizational skills, showing courage to take initiative, and demonstrating personal and collective agency.

Self-management competencies can be seen in several survey responses. One respondent stated “Students learn to think independently and guide their own learning. They learn to persevere and keep trying until they find solutions to problems or answers to their questions.” This is echoed in other responses including one who indicates they want students to “work together as a unit to come up with a plan for meeting the task and learn from success and failures.” A third notes outcomes such as “seeing the benefits of planning and revising plans along the way; finding a way to do something independently or collaboratively (but more student-led than teacher-led).”
Participants anticipated incorporating maker programs would help students develop self-management skills such as identifying and using stress management strategies, and exhibiting self-discipline and self-motivation. One survey respondent expresses:

[b]eing in a high school, I think students need time and a place to be creative and have less structure. They're under so much stress with AP classes and trying to pass exams, that they rarely have time to relax or do something for themselves that's not school-related or going to be graded.

Other respondents note “kids needed a safe space to take a break from the traditional classroom setting,” “for the students to take a break,” and “as a mental stress reducer and something to offer a safe haven for SEL.”

Similar themes can be seen in interview data. Melanie indicates that one of the reasons she was drawn to maker programs is because of the opportunities they provide for students to take a break. Sophie believes maker programs provide an outlet from the pressures of high school:

There's so much pressure on my high school students, lots of work, lots of pressure to perform, going off to college, you know, and so, if they could just come to the school library and play a little bit. I think that they need that.

Isabel is hopeful that the makerspace will have a positive effect on behavior in classrooms because it allows students the opportunity to reset. She shares:

I think that if we can truly implement a makerspace, we can eliminate some of the behavioral disruptions. I've seen data, where students have become, they get penned up, constantly being in the same room. Everything is so regimented that if they're given the opportunity to say, come to the library for some downtime instead of always being in the
same contained space, that behavior issues decrease by having an outlet. And for a lot of our behavior issues, it seems that it's academic frustration that drives it. If they can be removed from the academics and be more hands-on, it may be more supportive to addressing their personal needs, and then maybe they can return to academia after that lunch period or study hall in here.

**Social Awareness.** Social awareness is recognizing and using resources and situational opportunities in families, schools, and communities. Participants, particularly other educator interview participants, believed maker programs would transform the library into the hub of the school – anticipating students and teachers would develop social awareness by recognizing opportunities to engage with the library in new ways. This is also relative advantage - increasing social prestige for the library and is detailed further in the next section.

**Changing Perceptions/Social Prestige**

Survey participants note the potential for maker programs to increase social prestige by changing the reputation of the library. One participant says they wanted “to make the library more appealing and attract more users.” Another notes “I wanted to increase attendance in the library and change the perception that the library is only for studying and researching.” A third said “we wanted to bring students into the library and show them that it can be a place for innovation and creating.” This is echoed by other respondents who indicate they want to “attract other students to the library who may not have come in before.” Similarly, another respondent states it “seemed like it would be a great way to highlight the library space and for students to gather and have fun while learning.” In each of these cases, the participants wanted to change how students view the school library.
Similarly, more than half of interview participants identified a need to change how students, teachers, and community members viewed the school library and in one case, the school district. This need was more prominent in responses from other educators in the school.

Administrators and other educators in schools indicate school libraries are not being utilized. Diane notes: “I think that in the current times, not a lot of people are coming to the library to get books, with the access of information and knowledge at their fingertips with our one-to-one devices.” Tony reports:

I think libraries have traditionally in our school, and in many schools, always been this quiet area for people to study and it should be more of a like organized chaos. There should be a lot going on. Students should want to go there, so like ‘wonder what's going to happen there today.’

Similarly, Patricia explains:

[my current library is] not very appealing, at least to today’s students and so it's not a sanctuary because they don't want to go. And, you know, we say like ‘Oh, we don't have this special space’, but if no one's using that space, and it's beautiful - and ours is particularly beautiful - then to me it's almost like a painting on a wall. It's there but it's not being appreciated. It's like a painting on like an alley wall actually, because no one's even passing it, and so you're not even getting a chance to appreciate its beauty.

Jess notes, “My superintendent wanted the library to be the hub of the school and to be busy all the time, and he wanted the makerspace.” Ana says, “that's what we want right? That they think first to go [to the library].”

School librarians indicate wanting to change how students and teachers viewed the library, which they anticipated would increase student and teacher usage. Maddie said:
when I started the library had kind of fallen to the wayside, it had grown old, and people were not interested in using it. I wanted to bring the library back to life, that was a major goal for me. I really wanted it to be the center of the school. And I believed that a makerspace could do that. I wanted teachers to use it in their classes, as well as students to use it on their free time.

This is echoed by Melanie who explains:

I want the library to be seen differently than how it has been seen in the past. I want the library to be a hub of the community. I think having the makerspace here and the interaction with the students, I think that will help bring that dream to life.

Isabel further elaborates:

my goal is to turn the library into the hub of the school. The library’s not a quiet place. I'm not an old schoolmarm that says ‘not a sound,’ because that is not what a library is… if we [can] get away from the stereotypical vision of the word library where we think of it as a quiet place with books only, we might be able to very easily progress into where my goals are taking us.

Participants wanted students to change their perception that libraries are only for books and readers. For example Ivy explained, “I wanted to give room for kids who maybe were not natural readers, but they had this creative energy, for them to find another way to have a place in the library.” Similarly, Danielle believed maker programs would “bring more kids into the library, it would open it up … the library wasn't just about coming in and getting a book anymore.”

One administrator hopes that the makerspace will change perceptions about the school district within the community. Sam notes:
I think that there is a sense from a number of the community that [this] is a failing school with lots of needs. I think they believe that there are some programs that are stagnant. I think that if we can show them that through different programs like a makerspace, and their students come back [home] and they talk about how exciting school was, that can maybe change the philosophy in the feelings of some of the families in the community.

**Support Learning**

Participants in this study anticipate that maker programs will support learning by improving resources access, supporting or supplementing the existing curriculum, and reaching students who may not perform well in more traditional formats.

**Improve Resource Access.** Survey respondents indicate one reason for adopting a maker program was to provide access to tools and materials students may not have access to elsewhere. One notes they wanted to provide “access to 3D printers for everyone in the building, not just our engineering students.” Another notes they wanted to “give students access to tools and projects they would not otherwise have.”

Similarly, there seems to be consensus among interview participants that students in the school may not have access to the types of tools, materials, and activities maker programs provide. For example, Melanie was attempting to address a resource gap:

we have a very, very diverse district here. We have, 68% is reduced or free lunch, but then the other are very wealthy. And because of that, some of our students will never get to experience at home like a set of snap circuits, what it's like to build a circuit… I thought in its way, I was kind of trying to bridge that gap so everyone has access to these things, whether the family can afford it or not.
Similarly, Patricia believes maker programs help address “equity in terms of having so much available for every student.”

Debbie notes one of the purposes of maker programs is “exposing [students] to different things that they might not have had exposure to, materials that they might not have had exposure to previously, and different ways of thinking.” This is echoed by Emily, who says:

I feel like this is a way just to get exposure to different things that are out there. I mean you know, not everything, but just a taste of like other things that they don't get exposed to any place else.

Diane says “bringing in more STEM related activities are definitely going to be a positive in our rural community where STEAM really may not be as accessible in this area as other areas.”

At the same time, participants note that tools and materials are not the only resource students need – they also need space and time. Sophie explains:

at the high school level my students are in their classrooms for 42 minutes, and then they have to leave and they can't go back in there, because those classrooms are being physically used for something else. They need a place where they can continue the work that they were doing in the classroom, and if they were doing some kind of makerspace type of activity or something that required making, they could continue that during the school day in the library, and they didn't have to wait to get home and do it. And if they didn't have supplies at home they'd have to wait until the next day in the classroom.

**Support or Supplement Curriculum.** Participants anticipate maker programs will support and extend classroom curriculum. Among survey participants, one notes “[w]e provide makerspace activities throughout the year that support the school's curriculum and also provide student choice.” Another says the maker program was started to support “curriculum
assignments that required the students to produce something creative as part of a grade.” A third states “I started our makerspace as a way to involve the library in our school's mindfulness initiative. I now often collaborate with teachers who are looking for new ways to assess learning and who are looking for ways to up their game in the classroom.”

Sophie said “my goals were really to support what was going on in the classroom.” Sadie said she wanted to provide STEM opportunities for students, and Jess noted she wanted students to “connect math and technology.” Cindy says “it's my understanding that makerspace in general was started to encourage students at all ages to experience the engineering, the science, the technology. For us it's designed to get those technical skills, get the children exposed to those types of skills.” Trinity notes:

I think that the [anticipated] benefits were for people to have a place to use their creativity, along with things that they've learned in curriculum like you know science, the arts, and things like that. Where they could take the information that they learned and then be able to put it into a hands-on experience.

Similarly, Matt says “that hands-on translating what they're doing in the classroom to something physical they can do is huge.” Matt also notes that the hope is “that music and certain teachers really utilize it as part of their classroom. You know, reserve it, bring their kids up there to do stuff whether it's math, science, the arts.”

One survey respondent indicates:

Our kids really need to explore other avenues and interests besides English, Math, Science, History, and Foreign Languages. Not all kids fit in that box and certainly don't fit in the "college box." I feel also school should be a place to learn all sorts of skills and
ideas and explore areas you may wish to make a profession, particularly at the high school level, as well as a safe, fun place, too!

**Advantage Over Traditional Formats.** Survey participants suggest that there are advantages to maker-style learning over more traditional forms of education. One survey participant notes, “I found that students crave these opportunities, and retained information better.” One clear theme in responses is that the school librarian was seeking a way to reach students that is different than they were experiencing in the classroom (rote memorization, worksheets, assignments, teacher directed, step-by-step directions) or what they perceive as missing from traditional classrooms (hands-on learning, authentic experiences, student driven, creativity, freedom, self-expression, opportunities to move and talk) or school library (excitement, engagement, fun) previously.

One respondent says they had “a desire to engage students in ways that were perhaps different than what they were used to … more student focused/driven, and more problem based.” Another indicates “the desire to provide new avenues of learning and exploration for my students.” A third states “To offer new experiences and STEM activities for students without confines of worksheet and rote memorization activities.” This desire to provide something different than what students were previously experiencing is also related to student engagement in learning, and in the library.

Many respondents indicate that making is fun or engaging for students. For example, one participant says “it engages students in different ways and they believe they are having fun.” Another participant believes “hands-on learning allows students to be more involved in their learning.” A third indicates “I wanted students to become a stakeholder in our space and give them more ownership of their learning and time in the room.”
These themes can be seen in interview participants as well. Diane states, “I think that makerspaces could reach some students who may not be engaged in traditional curriculum, it might be a different avenue for them to access some knowledge.” Similarly, Tony anticipates that maker activities will “increase student interest in taking part in these activities, and learning outside of traditional class assignments.” Matt believes maker programs provide opportunities for students who do not traditionally thrive in school, and states:

There's always those kids who don't bode well with your standard written homework, written tests, that stuff. But give them a project and say do this, make something that shows me you understand X, Y and Z, and allow them to explore that on their own, and I think they'd be a lot more successful.

Sam emphasizes “we have to start looking at making sure that students are starting to think differently than they have in the past, in traditional classes. STEAM is something important for the future.”

**Observability of Maker Program Results**

The observability of the results of maker programs is the second most prominent driver of maker program adoption in school libraries. Visibility is related to both trialability and visibility. Participants note that seeing the results of maker programs both in their libraries and in other libraries prompted them to adopt.

The ability to try maker programs in small parts before full adoption is evident in several responses, for example: “I've always offered games, coloring, origami, etc....just added more stuff as time went on.” This is echoed by another participant who indicates they built on what was already in place: “It was started before I came to my school. At that time it was mostly
Legos and construction. I had added a lot of technology, robotics, 3D printing, arts and crafts and more.” A third respondent notes:

We had many DIY and craft books but students did not have access to the materials to go with them. I started by purchasing duct tape for students to take out with the Duct Tape book. Then added yarn and needles for students to borrow with the How to Knit books. It grew from there.

Nearly all school librarian interview participants indicate they started small with their maker programs and added materials and activities as time and funding allowed.

Maddie notes: “I started very small. I had Bloxels and just a couple of small things and the students were interested in that, and as the principal saw the makerspace starting to attract students my budget grew and I was able to grow my makerspace and to what it is today.”

Similarly Jess says, “we started with basic things like Legos, K’nex… [I threw] a bunch of Legos out and these kids just dug right in, and they'd start creating little cities and stuff, so I made a Lego table.” Sadie reports:

I started out small, with pop up makerspace tables that had one item on it that I would be introducing to the students. It could have been a robotics thing, it could have just been putting a bunch of Legos out or K’Nex or just different things like that one, at a time just kind of seeing how the students reacted to it, and if this was something that might be a possible thing to have in the library.

In the case of school library maker programs, it seems that the trialability enabled some school librarians to observe the results of makerspaces before making a decision to fully adopt, while others had seen results in other places.
One respondent notes: “As a former elementary teacher, I worked at a school where making was a central aspect of learning. I’ve witnessed the positive effects of making on all sorts of students over and over again.” Another says:

“It was trending, but it was the student response that got me really motivated. All kids like the making process...we typically follow the Engineering Design Process and it has shown me how infrequently children are allowed total freedom of creation and design. Many struggle with all the freedom at the beginning of projects, but by the end they see their own growth and are so proud of how they kept on going...asking more questions and making improvements! So much fun!!”

Rogers notes that in the decision stage, it is not always necessary for the individual to try the innovation themselves, that in some cases “trial of a new idea by a peer can substitute, at least in part” (p. 177). Many survey and interview participants indicate seeing the results of makerspaces discussed in blogs, in professional learning communities, at conferences, and in professional publications, and wanting the same results for their students. One respondent notes: “Listening to librarians around the country introducing makerspaces in their schools and the successes their students accomplished. I wanted my students to be exposed to a learning space that was highly engaging yet challenging.” Another notes “I liked the idea when I saw so many others doing it successfully.” Nearly all school librarian and administrator interviewees indicate visiting libraries with maker programs to see the results.

**Consequences**

The interview data reveals a multitude of consequences from implementing maker programs in school libraries. First, the data identifies five main desirable consequences of implementing maker programs. Maker programs have changed stakeholder perceptions of what a
school library is, and what it provides. Second, they have changed perceptions about what school and learning are, which results in an improved image for the library and school, and improved climate in the library. Third, implementing maker programs has increased library usage by students and teachers as stakeholders recognize the resources they provide. Fourth, maker programs have increased support for student learning in three ways – increased resource availability and utilization, increased collaboration with classroom teachers, and improved relationships between educators and students. Fifth, maker programs have improved students’ social emotional skills by increasing self-awareness, self-management, relationship, and responsible decision-making skills.

Second, the data reveals unanticipated consequences from implementing maker programs among participants in this study – all are desirable. First, increased collaboration with teachers, and between students was not anticipated by some participants, and students using the maker program was not anticipated by one high school participant. Second, the data indicates that maker programs help school librarians and other educators move from more teacher-centered to more student-centered philosophies, and third, position school librarians as change agents in their schools and districts, as well as in the wider community.

Third, the data reveals three main undesirable consequences of maker program adoption. Implementing a maker program increase workload for school librarians and other members of the social system, change financial costs for the school and the librarian, and increase risk. The consequences revolve around obtaining, managing, and maintaining supplies, materials, and equipment, renovating or modifying the library space, training, designing and implementing activities, and disappointing students.
There seems to be agreement among school librarians and other educators about the consequences of implementing a maker program. When there is not consensus, differences will be noted. Table 9 summarizes the anticipated and unanticipated desirable and undesirable consequences. Although some consequences were not noted as anticipated by participants, based on previous literature and the researcher’s experience, they have been classified as anticipated. The following sections provide details of these findings.

**Table 9**

*Consequences of Maker Program Implementation*

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<th>Anticipated and Desirable</th>
<th>Anticipated and Undesirable</th>
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<td>1) Increase workload</td>
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<td>a. Obtaining, managing, and</td>
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<td>c. Improve climate</td>
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<td>2) Support student learning</td>
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<td>utilization</td>
<td>c. Training</td>
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<td>b. Increased Collaboration</td>
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<td>c. Improved Relationships</td>
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<td>3) Improve students’ social emotional skills</td>
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<td>a. Self-awareness</td>
<td>a. Obtaining, managing, and</td>
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<td>b. Self-management</td>
<td>maintaining supplies,</td>
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<tr>
<td>c. Relationship</td>
<td>materials, and equipment</td>
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d. Responsible decision-making  

b. Renovating/modify library space  

c. Training  

3) Risks  

a. Obtaining, managing, and maintaining supplies, materials, and equipment  

b. Failure  

c. Training (lack of)  

d. Designing and implementing activities  

e. Disappointing students  

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<th>Unanticipated and Desirable</th>
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**Anticipated and Desirable**  

There seems to be agreement among participants that there are a multitude of desirable consequences of incorporating maker programs - every participant noted more than one, and the
consequences appear to be interconnected. In general, interviewees indicate that makerspaces and maker activities have changed perceptions, improved climate, increased usage, increased support for student learning, and improved students’ social emotional skills.

**Changing Perceptions, Improved Climate, and Increased Usage**

Overwhelmingly participants report that incorporating maker programs has changed the way students and teachers view and use the school library as they recognize and use the resources and opportunities available.

**Changing Perceptions, Improved Climate.** Students and teachers have come to recognize that the school library provides a variety of resources that support learning and social emotional well-being; they are no longer viewed as silent book repositories. Jess notes, “they're excited that they get to play with something in the library, and it changes their perception of about what the library is, or what librarians do.” Students have come to see the library as a place to have fun, a safe space to make mistakes, and a place to relax and reset. They have begun to recognize that the library offers something beyond books and is a place for more than just readers.

There seems to be agreement among participants that incorporating a maker program has improved the climate in the library - the overall emotional state, or attitude, of a collective group of people. Ana says, “I think it's had a huge social emotional positive impact on kids.” Words such as “fun,” “excitement,” “joy,” “passion,” “play,” and “happiness” are evident in nearly all interviews. Trinity shares “word of mouth brings happiness about the space. Before you were here doing homework, or reading, or being quiet. I think the community is aware that this is a place that is not that anymore. That the media center is so much more than that.” Melanie notes:
the whole atmosphere of the library has changed, and I definitely attribute the
makerspace to part of that, because it's fun, and they realize that they can come here, they
can learn, they can read, but they can also have fun.

Danielle says “there's this buzz of energy and excitement in the library space, kids are very
happy to be there, and there's such a difference. When I first started, the libraries were so quiet.”

Jenn adds:

it's given the kids an opportunity to just feel like there's something fun, and like it's a safe
place to make a mistake, or make something ugly and nobody's going be like ‘eew look
what you did’ because it's just there for them.

Maddie echoes this, sharing that “students found a place where they felt comfortable, where they
could try things. Where they could try things and fail, and try the same thing over again, or try
something completely different.” Patricia says:

it's kind of a natural space, where kids could fail safely without feeling like ‘oh I’m going
to fail and get a failing grade’ or anything like that, and it was something that. … it was a
very low-pressure place.

Debbie also notes “what we were seeing was students really coming in, feeling comfortable
having a place that they could go.”

Participants also report excitement, eagerness, joy, fun, awe, gratefulness, and happiness
displayed by adults in the school, including themselves. Matt says when he first learned about
the makerspace he “was super excited about it.” Similarly, Sam says, “I am excited for the
future,” and Trinity reports “I’m grateful to be able to be a part of the space.” As participants
described different activities that have taken place in the library, they consistently use terms
positive terms, and Emma reports:
The past two weeks I have been as happy doing my job as I was before the pandemic. I've been searching for my footing [and I found it] because makerspace is what's come back to the library. To help give it that feeling of joy.

Participants indicate that students have begun to see the library as a place to relax and reset. This is evident in respondents from all grade levels. Jenn says, “I think every kid, even the kids who don't even like crafts, or even the library very much would say, well, the library is like it's a great place where you can go and just relax.” Sadie shares a story about one of her students who often had to leave classrooms and reset himself to be able to return to class:

He would come in and he would start putting Legos together, or he would start putting together different makerspace kits that I had, and it was just his way of calming down, and being able to readjust to be able to go back into the classroom. And it happens with a lot of the students that normally struggled in school, they were coming in, and they were really utilizing the makerspace to do all kinds of things.

Melanie echoes that students are using the space to calm down and reset. “I have kids that come in sometimes, where they just need some downtime and they're able to do something like that, and just calm, so almost like resetting their mindset.” Trinity also notes downtime as a reason students are using the makerspace:

This is a place where not only can they come be creative, but they can also have their downtime from looking at a computer screen, or from reading a textbook, and it’s helped influence the kids from looking for [another] place to go to.

Students have come to recognize that the school library is a place for everyone, not just readers. Ivy reports:
The number of kids who, when they see something, they assume that they can learn, to touch it, and play. They can use it. It's theirs. So the understanding that the library space is for them. They don't have to be a big reader to be successful in the library. So if you're not a kid who enjoys browsing for books, you can just sit at the table and paint by numbers with stickers. They know that there's papers to color with, they can take out the origami books.

Interviewees indicate that in addition to changing perceptions about what the school library is, and what it provides, implementing maker programs has changed perceptions about school and learning, for students, teachers, and community members. Patricia shares:

This idea that learning only happens in the classroom is an antiquated one, and so I think makerspaces invite this idea that the library media center is a place to come to where you can learn on your own without the guidance of someone else and it's just reshaping learning, and even attitudes towards learning … it allows kids to see school differently, because there's just another space where they can become a part of it… Sometimes it's just about feeling like they have been respected in terms of like it's valid for me to want to create something and that school is inviting me to do this, and so I think it helps to transform attitudes towards learning overall.

Emily notes “I got an email from a parent saying that her son loves school again, and she's pretty sure it has to do with my interactions with him in enrichment time and makerspace.” Emily is not the only one to report that students are talking to their parents about the maker program. Debbie notes that the makerspace is “building an awareness that the school was able to be responsive to the way the world has changed.” Tony says, “I feel like the parents feel more trusting that our school is providing a real educational experience, a well-rounded one for their children.”
**Increased Usage.** Increased student usage is evident in many responses. Maddie explains “I think the biggest result is that the library became the most popular place in the school. Kids wanted to be there.” Danielle notes, “that level of engagement is really there, and not just at the elementary, it's all the way through… the kids that are there, they're totally engaged, they want to be there.” Tony reports students ask when they can come back to the library after participating in a maker activity. Patricia says, “it drew kids to the library,” and Cindy notes “the kids, they are eager to get in there and create and build.” This is also echoed by Sadie who said, “One thing that I noticed right away, it really brought a lot of students into the library because word of mouth spread so fast.” Jess also saw that word-of-mouth increased attendance:

They just want to come down, they want to stay after school, they want to come down during lunch. They want to bring their lunch with them, the kids come down to the library. The kids that come in they're bringing their friends in, so I my clientele ramps up... We're busy. There's not a moment when there's not a soul in the library. I feel like my doors are revolving doors. Kids come in, kids go out, more kids come in.

Trinity notes that she did not anticipate the makerspace would be as utilized as it is:

I anticipated less interest at this grade level, and I was surprised by that. I anticipated that it would kind of fall flat for a while, but it was the opposite, and it actually brought people into the space. Children talking about it, which brings in the faculty, who is now also involved in saying “wow that's great.” So anticipation wise, I was happily surprised.

Maddie also reports that along with increased use of the library by students, teachers changed their views and usage of the library:

The energy that came along with [the makerspace] brought the library back to life. That's what teachers started noticing, and that's what brought teachers in. Whether it was to use
the makerspace or to do a lesson and research or for whatever reason. It was like saying ‘hey we're here, and this is what we're doing’ and it showed that the library was innovative. It wasn't old and dying, we were alive, kicking, and moving forward. Ivy echoes this, and notes “I think teachers realize that what we do isn't just books.” Participants note changing perceptions and increased usage of the library increased opportunities to support learning.

**Increased Support for Learning**

Adding maker programs has allowed school librarians to support learning throughout the school in three ways – improved resource access and utilization, increased collaboration, and stronger relationships with students.

**Improved Resource Access and Utilization.** Participants described a wide variety of materials in their makerspaces including arts and crafts materials, coloring, sewing machines, knitting, button makers, Cricut machines, building sets (legos, K’Nex), and board games. Many noted robots (Spheros, Ozobots, Lego we-doo), circuitry (Makey Makey, little bits, snap circuits), Raspberry Pi, Hummingbird robotics kits, 3D printers and other technology. Many participants report that providing access to such materials has improved the learning experience for students. Jenn reports:

We live in a community where we have 50% on free lunch. Mom and dad are not buying poster boards, and you know Styrofoam this, or hot glue that. So we're able to let these kids make whatever they want to make for their museum artifacts now.

Cindy says “at the elementary school level they are certainly exposed to technology that they wouldn't have ever seen anywhere else,” and Debbie says maker programs are “showing them new tools that they wouldn’t have been exposed to previously.” Maddie echoes this with “we
come from a very mixed community and a lot of students wouldn't have access to the robotics and the 3D printing and all of that, if it weren't for this makerspace. So it opens up their opportunities.” Increased resource access for students is also noted by Sophie who says “[students have] come to expect that these things are available. … Resource availability has improved, and they understand that.” Similarly, Ivy notes “the kids get [that] the resources are here for all of them.”

Tony notes “I think it's great to get teachers, kids, and even other staff and the community aware of what we have available to us.” Teachers now recognize that the library provides resources beyond books. Emma recounts that teachers come into the library and ask to use materials, “they come in and they’ll be like ooh…Can I borrow that?… ooh I want to get one of those?.. ooh that worked!” Similarly, Ivy and Sadie indicate teachers ask to borrow materials. Along with recognition of resource access and utilization, collaboration with classroom teachers has increased.

**Increased Collaboration.** Teachers have come to recognize that the school library and school librarian are able to provide both physical resources – in the form of materials – and also that they can act as instructional partners in subjects other than English Language Arts. Many participants noted that the maker program led to increased collaboration with teachers from a variety of disciplines. Ivy explains:

I think every library everywhere struggles to connect with, like, their math teachers. Because like, hey Mr. Sir Cumference, the book, you know, there's not a lot. But coding and math that's kind of the design elements and all. They see that connection, that I could be an ally to them too in a way that an ELA centric teacher might already have a partner,
now a math centric person, science centric person, realizes I know some of their things and that they would want me to be a partner.

Jenn shares that teachers started to ask for materials to help students with project-based learning, and recounts a collaboration involving two departments, made possible by materials available in the makerspace:

I’m working with a music teacher and our power of voice teacher. The kids are coming up with images for causes that they are passionate about, and they get to make three buttons for their cause. We're calling it a button-palooza. But that's like, being an option for teachers to go outside the box, with an activity and they don't have to incur any expenses. They don't have to learn anything about button making. I just can ‘here we go, come to the library I’ll show you how to make buttons’ and boom they're off making buttons.

Emma explained a collaboration with her English as a New Language teacher where she was able to act as an instructional partner:

she had two or three students working on animal research. And they were doing their projects and she said, ‘look I made little masks and they're going to interview each other,’ and I said let's get the green screen, let's do the background.

Jess recounts a collaboration with a physics teacher:

It was a basic physics class and I asked her, ‘will you come down and we can have the kids build cars, but they have to build them out of trash: water bottles, toilet paper rolls’… so we gathered a bunch of stuff and we said ‘okay have at it and then we're going to race them down the hall.’ They had to look up the physics part of it, and they built cars out of recyclables. It was a blast, we had a great time. Then we raced them in the hallway.
Those kids, half of those kids, I would have never seen in the library, because they didn't want anything to do with going to the library. But after that I kept my bin of trash and they would come down and be like ‘Okay, I want to build another car, and do better,’ so that was kind of fun, the kids learned. I learned.

Sadie’s experience mirrors what other school librarians share, “[teachers] love the fact that we can collaborate to do things where normally they might not be able to have the supplies, or the items to work with their students. To have that ability to be able to co-teach has been a wonderful thing.” She notes that collaboration with teachers was an unanticipated consequence for her:

[When I was starting the makerspace] I was not even connecting makerspaces with the curriculum. That was something that changed over time. Now there's a whole coding class that uses my makerspace and there's all these other times where I’m collaborating with teachers to bring makerspaces into the curriculum. I had never anticipated that that was going to be the case.

Tony recounts several collaborations, and notes that maker activities have helped teachers exchange ideas to improve learning experiences for students. “For staff, I think it's really great to make each other aware of what we all can do, to get classroom teachers…everyone working together rather than everyone in their islands or they're defined roles.” He goes on to say:

It's neat to see what could be possible with the makerspace. When we first started planning these activities, it seemed like we used every idea we could think of. Then all of a sudden you try to do another one, and then there's a whole new set of ideas. You have new people contributing and bringing their ideas and expertise in, so I think that's kind of neat to see.
Similarly, Matt shares a variety of collaborative activities in the planning stages with the school librarian, and that students also inspire activities:

We did a room building design project, where they're redecorating the room. And they had to lay it all out. One of the students has his own 3D printers and he printed a model of his room. He designed it in TinkerCAD and 3D printed it out as part of his project. The inspiration for us comes sometimes [from the] kids themselves. [They say] ‘I’m going to do this’ [and] I think ‘hey that's a great idea to get the kids to three dimensionally model their rooms or a space on the computer’ then [that leads to]’ we're going to go to the makerspace and put it in play, and actually generate a model of what you've designed’

Danielle recounts how green screening became popular in many schools she oversees once teachers saw the results:

there's a lot of schools that are having kids make videos and having them use green screens. The creativity that comes out of that is amazing, They're talking about, for example, the revolutionary war. We had students build this whole scene, and then record it using a green screen and we were amazed by what they did, and what they learned from it.

Debbie says “the library [is] a place where everybody goes to collaborate now, and there are so many resources there.” Improved resource access, and increased collaboration with classroom teachers has also allowed students to build different relationships with students.

**Improved Student Relationships.** More than half of school librarians report that the makerspace has allowed them to build better relationships with students, which allows them to
better support the learning process as they found out more about students’ abilities, working styles, and interests. Ivy says:

I’m in their classrooms teaching them how to cite. [In the library] they know to come get me if they want to get a recommendation for a book, but this lets me get to know them and their creativity, and their working style.

Maddie notes a change in relationships with students as well. “We could talk about what they were doing and even if they were only playing a board game, I could be a part of that, so the relationships between the students and I grew tremendously.” Sadie recounts how interactions with one student allowed her to guide the student into an educational opportunity:

I have a student right now, who, for a couple years has not been doing so well in school. I saw that she really was into the tech stuff that was in the makerspace, and I asked her if she wanted to be my tech aid, helping with the makerspace and with technology. As a result of this she's now going to be going to BOCES full time to be in the computer science program. I think that there's a lot of stories like that that happen, you know, as a result of makerspaces. It's surprising how much inspiration kids get out of that space.

Jess says "I'm building a relationship with the kids, and so when they come in and they need help with citations or with their science fair project, I know [them].” She shares one example where a student wanted to do a science fair project about Spider-Man, and she used her knowledge of his interests to guide him to a project that was more appropriate:

we had a long conversation about why he couldn't do Spider-Man, and what other things he could do. Then I realized, this kid is in the library every day during his work hall, and he's playing with the building straws. So I said, ‘what can you do for your science fair
that you already play with? You already play with the straws and the Legos, what can you do?” And so he ended up bridge building, but using the straws instead.

Emily notes that relationship building has also helped with classroom management. “I’ve gotten to know a lot of students better, and for some of them that connection has helped behavior in the classroom as well.” Patricia indicates that maker programs allow everyone to learn more about each other:

it gives another opportunity for adults in the building, and for peers, to see others in a new light. We tend to, in schools, pigeonhole students into these boxes of like, ‘okay this student is a jock’ or ‘this student likes science,’ or whatever it happens to be. It's very hard for us to conceive of them outside of that label. And I think what makerspaces do is they help to chip away at some of those labels and create new places for us to get to know kids, which creates a sense of belonging, which develops interest, which develops motivation which develops academic achievement. So there's a lot of upside benefits there. But most of all, I think it allows people to get to know different sides of one another, which is always a good thing.

Improved resource access, increased collaboration with teachers, and improved relationships with students results in better support for the learning process, which ultimately leads to improved student learning. In the case of school library makerspaces, the most prominent improvement appears to be in students’ social emotional skills.

**Improved Social Emotional Skills**

Although a few participants note an increase in specific content knowledge such as circuitry, overwhelmingly they speak about increased social emotional skills for students.
**Self-awareness.** Developing a sense of purpose is evident in the interaction Sadie shared previously, where a student will now be attending a computer science program after her experiences in the makerspace. Participants report several ways that maker programs are helping students become aware of their own interests and abilities, and that students are experiencing self-efficacy – recognizing that they understand or can do something. Melanie describes working with a sixth-grade class:

> I have students that are in 12-1-1 [special education] combine with students who are in honors classes, and when you get these two kids, and they build a circuit together, and the excitement on their faces. Like, ‘I understand this’, but then, when they go off the directions, and now they're building circuits that are not even on the plans, and they're putting things together from different sets. And they’re understanding circuitry, and they realize they are understanding circuitry. It's really, it's amazing to see. The happiness.

Emma reports a similar reaction from students when working with circuitry “if they can get a light bulb to go on, if they can get it to play music. It’s as if you'd given them a bag of gold.” Isabel reports that her students are not used to independence, but are becoming more comfortable:

> they are finally getting a little more comfortable with the idea that they are their own driver. They don't need to come to me for every step of approval to progress - and that's been the biggest hurdle because they're so used to [asking] ‘can I go on to this?’

Patricia says “it allows students to not only create, but to toy, in order to discover what it is that they want to create and it gives that space to create it, to break down, to fail, to succeed.” Finally, Emma reports:
I have witnessed with my own kids, the kids who academics may not be their thing - we're sitting on the rug listening to a story and they're the kids that are rolling around or whatever - they're my kiddos that know how to do the circuit boards. And they shine and kids go to them, and it gives them pride and confidence and then, when we come back to do another activity, I feel like they bring that with them and so now they're rising to the occasion of a more academic looking situation.

As indicated in Emma’s account, self-awareness may help students with self-management skills.

**Self-management.** As indicated in the changing perceptions of school libraries, students have identified the library and makerspace as a place they can rest, relax, take a break, and reset, and are using the space to do that. Many participants indicate students coming to the library to engage in calming activities.

**Social Awareness.** Social awareness is also evident in the results detailing changing perception of the school library. Students recognize that the library provides resources beyond books and are utilizing the materials. Sadie explains that in her makerspace:

> A lot of exploration was going on, because, as the makerspace grew, I started adding things that were craft items, like yarn and crochet hooks, or stamps or punches with card stock, and origami paper with origami books. The students just started coming in and sitting in little pairs, just sitting, and talking, and doing these things.

**Responsible Decision Making.** Participants note an increase in students’ responsible decision making skills - including demonstrating curiosity and open-mindedness, reflecting on one’s role to promote personal, family, and community well-being, and identifying solutions for personal and social problems. School librarians report that the freedom offered by makerspaces has led to creativity, ingenuity, and problem-solving for many students. Sadie recounts an
incident when a student used a 3D printer pen to fix his earbuds. “He used the 3D pen to cover around the frayed part that was attached to the earbuds part, and he got them back working. They really take the makerspace stuff, and they figure things out.” In one case, a student recognized that he could combine the resources in the library, and the expertise of the librarian to help him solve a problem. Jenn recalls “I had a kid rip his pants and he's like ‘can you teach me how to sew my pants back together’ I’m like ‘Absolutely.’” Jenn also notes that students have taken ownership over the library and makerspace “I’ve got a crew of kids that have made the space their own. You know when the other messy kids come in and like, ‘no, no, this is where the paint goes, this is where…’ you know?”

Tony says, “it’s great to see students thinking outside the box, problem solving, and not a not traditional ‘just solving worksheet to pass Friday's test.’” Debbie says:

we saw a lot of creativity happening, where students would come in and ask ‘can I use the 3D printer to do this? What programs do I need to use to create it?’ So I think a huge benefit of it was just having the space, having the students ask questions about different things in the space, and really supporting their curiosity, answering their questions, showing them new tools that they wouldn't have been exposed to previously. Patricia notes, “The way the library was constructed … what it invited was curiosity.”

**Relationship Skills.** Improvement in student relationship skills is one of the more prominent desirable consequences related to students’ social emotional skills. Nearly all school librarians, and half of other educators interviewed report students are gaining relationship skills by participating in maker programs. As noted previously, maker programs are allowing school librarians and other adults in the school to build different kinds of relationships with their students. Participants believe that makerspaces and maker activities are not only resulting in
better relationships between the adults and students, but also that makerspaces are improving relationship, communication, and collaboration skills between students. Trinity says:

I think the biggest benefit that I’ve seen in this particular building is the social skills. Students may or may not know how to communicate with each other, after the whole COVID time and people just texting. Sitting down at a table and having hands on things and talking about what they’re doing goes a long way. I think that the social part of it has been the biggest positive thing that I’ve noticed from the space.

Patricia says makerspaces “gave students an opportunity to interact in meaningful ways.” Sadie believes that socialization and communication patterns changed because of the maker materials and led to student collaboration. She notes “it really brought a lot of students in, students who were not usually socializing with each other. The kids were actually communicating with each other on trying to figure out [the materials].” She goes on to explain that as students worked together, they started creating things together:

people [came] in and one person would build one period, a little bit of a K’Nex project, and then the next period somebody else would. They were so respectful. They would add on to it, and you know, so there was really like this camaraderie, like this really respectful thing happening in the makerspace.

Similarly, Danielle reports “kids are working collaboratively, they’re working in groups, they’re working on building something together.” Sophie reports students working together, helping each other, but not always on the same project:

[I’ve seen] increased collaboration. You know, we have certain projects that go on in the physics classrooms. Let’s say where they’re building their bridge that has to carry a certain weight, and three or four kids will come together with their different projects.
They have different designs of bridges, and they'll come into the makerspace, and they'll work on them together. They'll critique each other's as they're working so that they help each other. They're not necessarily working together on the same bridge, but they're working with each other to make sure that each other's projects are going to survive the weight challenge. I think that has improved their ability to communicate with each other, constructive criticism, receiving, giving, and then that helps with the research and design process and all of that.

Maddie also saw an increase in collaboration between students because of limited materials, noting “they learned to collaborate because there weren't enough robots for 10 kids, so they'd have to work together.” Socialization and collaboration was a consequence Emily had not anticipated:

Collaboration and working as a team. That is a big thing, and I guess I hadn't realized how big that was when we started. But you know when you have a group of three or four kids working together, and someone says ‘hey, this piece doesn't fit’ someone runs and gets pieces, and says ‘well let’s try this one,’ and I can see how they're working and thinking together.

Emma notes: “the collaboration that I see among them. Like truly working together …they fight more over my little stuffed animals than they do over makerspace.” Finally, Sadie notes that students are exhibiting leadership in the makerspace, by teaching others:

I noticed students teaching other students. It was nice to start seeing somebody that knew how to crochet, then other people come in and behold, ‘what are you doing?’, and then you would see them start to show them how to crochet and it just that's kind of how things blossomed.
Unanticipated and Desirable

Unanticipated consequences are those that are not expected at the time of adoption. For school librarians and other educators, it seems the unanticipated consequences from implementing maker programs have been desirable. As previously noted, Emily was not expecting student collaboration, Sadie was not expecting the makerspace to be used in the school curriculum and open opportunities for collaboration, and Trinity did not anticipate that the makerspace would be popular in the high school. Two other unanticipated consequences include 1) a change in attitudes and beliefs, and that 2) many school librarians have acted as change agents – within and outside of their schools. The following sections detail these results.

Attitudes and Beliefs

A majority of participants identified at least one change in their own attitudes and beliefs as a consequence of implementing maker programs. Most notably, participants said they needed to better understand making and makerspaces, and they needed to change the way they view teaching, learning, and school – they needed to let go of control.

Maddie says, “I think it's no lie that librarians tend to have control issues in general.” She goes on to explain:

relinquishing that control of the students was a little rough at first. I had to accept the fact that things would break. Things will get lost, things would disappear. [There was] a lot of letting go and allowing the kids to have that freedom to do what they wanted to do.

Tony also notes that he had to learn to let go of control, in his case when collaborating. He says:

I have a hard time giving up control. Whenever I was in the classroom having a co-teacher, I really had to make an effort to give up some control and work well with
someone because I wanted it to be my way. I want to make sure it's done right and so it's really important to recognize other people's strengths and your own weaknesses.

Sadie recalls that in the beginning she needed to understand more about what makerspaces were to feel comfortable. She also notes that she had to change her stance toward teaching and learning, and let go of control:

it was really hard for me to understand that I did not have to be an expert at things that I was putting out. I was always thinking ‘I have to be an expert, I have to understand everything that I’m putting out in the makerspace.’ And I think that was a challenge for me to get over and understand that my role is not to be the expert here on this stuff, and it's not always a teachable moment on my end. It's for the students to explore and learn and problem solve. That was a hard one, to let go of control.

Diane also notes needing to let go of control of the structure of learning experiences:

You can't put too much structure to it, because then the students aren't as interested in conforming to the structure of what you believe the makerspace should be. It should be more about what they believe and want to make in that space. So I think one of the lessons is that control piece - where as educators and instructors, we want to be in full control and in that makerspace we may not be all the time.

Patricia, a building principal notes, she has changed her beliefs about school libraries, which resulted in realizing she needed to let go of control in terms of student accountability:

I will say that my philosophy about library spaces has completely changed as an administrator. I've seen all kinds of libraries... I think schools have to shift their philosophy about how libraries are used, and when they're used. This whole idea of you need a pass to go there, and only during certain times. Yes, they should be going to class
when they need to, but when they have a free time, I think schools need to do more to invite the use of that as a place for you to do learning, and to stop seeing school as only happening within the four walls of a classroom. I didn't used to think that way. You know, it was about accountability, but I do see the value in giving kids the freedom to be in a space and being free in that space.

Emma notes a shift in how she structured learning experiences in her library. She reports:

the strictness of my centers has changed. I used to assign centers like this is your week to do puzzles, this is your week to do this. Makerspace has made me rethink assigning it because I would like them to be exposed to everything.

These participants, and others, learned to let go of control, and provide students more freedom.

Emma reported another unanticipated consequence of maker programs related to her beliefs. Emma recounts “in the beginning, I could not wrap my head around makerspace. I didn't see how it had anything to do with what I did in the library, that it would be distracting to my curriculum.” She later notes “I certainly didn't expect to like [incorporating maker activities]! I thought it would overtake reading time, but it has not.”

**Change Agents**

Another unanticipated consequence from implementing maker programs is that school librarians have become change agents, both within their schools, and in the larger community. School librarians found themselves educating students, teachers, and administrators about what the makerspace is, and what purposes it serves. They also found themselves influencing other librarians, educators, and organizations regarding makerspaces. This is also evident in interviews with other educators in the schools.
Within School. School librarians note that there is a lack of understanding among the teachers of what the makerspace is, and what it can provide. Sadie says:

I think the teachers saw it, but they didn't really understand at the time how the makerspace could help them with their curriculum. I think there was a little bit of a disconnect understanding why these things were in the library.

Tony says “I think, in the beginning, they weren't really sure, like it was a very foreign idea for people,” and Jess notes:

some teachers, I think the teachers that probably are more old school, think that I’m running a playhouse. I get comments like ‘must be nice to be able to come in during their study hall when they have 13 zeros in English and they can color’ or, ‘it must be nice for them to be able to come in and relax and do a puzzle.’

Similarly, Sophie says “sometimes I will hear snarky teacher comments like. ‘what are they doing? why are they coloring? what what's up with the arts and crafts?’” Debbie notes a similar lack of understanding from some administrators:

Getting the high school administrators, and also her peers, to understand the value in what she was doing and kind of answering the ‘why, what is this?’ Some people saw the crayons and the markers and they're like ‘why do we have kindergarten materials in our high school’ and it took a while to really translate the space to an understanding of the value of it.

Sophie says “I sometimes think that people outside the library world don't necessarily understand what a makerspace is, that they think that it's just a place to play, and it’s not really a learning space.” Participants indicate that some teachers and other educators in the school hold an
antiquated view of what a school library is, and what purposes it serves, and do not like the changes in the library. For example Maddie notes:

   It was loud and some of the teachers did not like that. They thought a library should be quiet, and even eight years in, and I would get comments [like] ‘this isn't how a library should be.’ Some of them couldn't let go of the idea that a library should be quiet and a place to study.

Similarly, Jenn says “ever since I took the job, the library has no longer been a quiet testing spot. And I think that annoys a few teachers.” Ana notes “Our teachers, when they want to use library resources, they're using them for their content. So they're really not looking at the makerspace at this point for their content. I think they're more into a traditional [library].” Patricia says:

   I think [the makerspace] really runs contrary to what some people conceive of what a library is. So the idea of a library media center in the two most dynamic places I’ve been is one that is a collaborative space that invites students to interact. So it's noisier… and the first look at it is one of collaboration and learning and interaction. For many, that is not what a library is … I think helping people to [understand], and some people don't ever come to understand, because they don't bother to try.

Diane indicates teachers need training, “I think that teachers need a little bit more training on what utilizing that space can look like in their rooms, and [how it can] fit into their instruction and curriculum.”

When faced with such challenges school librarians took time to explain to teachers and administrators what the makerspace was, and how they saw it addressing needs within the school community. In this manner, school librarians became change agents in their schools. Sophie
explained that the library, and maker activities are “really here to support what goes on in the classrooms, not to take away from what goes on in the classroom.” Maddie says:

The teachers need to see the value of bringing that type of work into their classroom, and that's something that needs to be taught. You're not just providing the supplies, you actually have to teach teachers why they need to do this.

Sophie says “that's part of my job - to educate them, to inform them of the purpose and how it can and does impact student learning.” Danielle reports “it started in the libraries, but it's expanding to the classroom.” Similarly, Tony notes “it's nice to have it spill into the classrooms. [In the] next few weeks I’ll be going into each of the sixth grade classrooms to do a coding activity. And then each of the sixth-grade classes, we’ll do a 3D printing activity so that's all kind of extensions of makerspaces that we've had.”

**Outside of School.** Participants in this study report school librarians influencing other librarians, educators, and community organizations as a result of implementing maker programs. They report hosting tours, offering professional development opportunities, training other school librarians, and presenting at conferences. Ivy recounts:

When I came to [this school] I had already started doing some presentations at NYLA [New York Library Association] and SSL [Section of School Libraries] about makerspaces, along with my [colleagues] about finding ways to do stuff that was beyond book tastings in the library. And so, when I came to [this school] one of the first things they had me do was present what I had been doing to my fellow librarians.

Emily has also offered training for the other librarians in her district about makerspaces and green screening, and has hosted librarians and community members in her space. Two other participants in this study, another school librarian and an administrator, credit her for being the
leader of maker programs in school librarians for the entire district. Emily notes “when we first started, my makerspace was a place where other librarians came to look and see how we do this in the first place.” Emily also reports that a local community organization requested a tour because they wanted to create something similar. Maddie similarly reports influencing a community organization. She notes:

The public library followed suit with me, and they started coming up with more hands-on activities. The public library’s right next to the middle school, so the students would go from my library right over to their library and kind of continue what they were doing, continue that innovation and imaginative work.

As a result of creating a makerspace in her library, Sadie has influenced a wide variety of educators. She says:

[Various administrators and librarians from all over the state tour my library to learn about [makerspaces] from me. Some have also done virtual tours or reached out and corresponded via email. Along with [my colleague] I created and ran two 3-day bootcamps and various other professional development workshops at BOCES throughout the state. We also presented at the NYLA SSL, NYSCATE [New York State Association for Computers in Education] and Tech&Learning Live conferences multiple times about our makerspaces. I have mentored school library student interns, and I have taught a graduate course on makerspaces in libraries.

Sadie also reports writing product reviews about makerspace materials for a practitioner journal.

Debbie says:

[My librarian] has all kinds of people come and visit her space. We've done virtual tours of the space, with schools around the country for people who were interested in the work
she was doing. So I think that, while the local community has benefited, the greater community of school leaders and librarians around the country have also benefited because they've been able to learn from what [my librarian] has done, and since she's been at the forefront of so much of it, you know, people want to want to learn from her so that's been a real bonus for the school and the district as well.

Many participants report visiting other school library makerspaces to learn more about what they involve and how to create them in their libraries. A majority of librarians, and some other educators report attending trainings led by Sadie and her colleague, or visiting one or both of their libraries.

**Undesirable and Anticipated**

Along with anticipated, unanticipated, and desirable outcomes, this study uncovers undesirable outcomes from maker program implementation. “Undesirable consequences are the dysfunctional effects of an innovation to an individual or to a social system” (Rogers, 2003, p. 442). They are negative or unwanted changes that occur from implementing an innovation. In general, participants identify undesirable consequences related to increased workload, changing financial costs, and increased risk. The consequences revolve around obtaining, managing, and maintaining supplies, materials, and equipment, renovating or modifying the library space, training, designing and implementing activities, and disappointed students. For the most part, although not mentioned as anticipated, based on literature and the researchers’ experience, they can be categorized as anticipated. The following subsections provide details about these findings.

**Increased Workload**

The most notable undesirable consequence of implementing maker programs in the school library is increased workload for the school librarian. Obtaining materials in any form
results in increased workload - time and effort - on the part of the school librarian, and others in the school. The increased workload for school librarians includes researching equipment and materials to ensure they are appropriate for the students, compatible with existing technology, and compliant with privacy laws. Workload is also increased by asking administrators for additional funding; soliciting, sorting, and organizing donations; writing grants; and ordering materials and equipment. Participants identified increased workload associated with managing and maintaining items – organization, procedures, and upkeep – as well as in modifying or renovating the library space. School librarians need to participate in both formal and informal information seeking opportunities to stay up to date on available maker products, projects, and facilitation practices; and they may need to train other educators about maker programs. This is in addition to the roles and responsibilities they already have.

The data indicates that maker programs also result in an increased workload for other employees in the system. Buildings and grounds departments may need to renovate library spaces, or build furniture. Administrators and librarians may need to seek out and apply for grants and other types of funding for materials, equipment, and renovations. Others who work in the school may be involved in managing materials, or setting up and facilitating maker activities. Teachers and school librarians need to plan or co-plan for maker activities, something they may not have done previously.

Many librarians noted obtaining items through community donations. In some cases, librarians specifically asked for donations, and in others, donations started once word spread about what was happening in the school library. For instance, Sadie notes:

Once people started hearing about the makerspace, whether it was teachers or parents that had come in for a parent teacher conferences or whatever, and understanding this space,
then I would get calls saying ‘hey I have all this yarn, could you use it?’ and that's how some of the items were obtained was just through word of mouth - not anything that I had asked for.

Similarly Jenn says:

People are always texting me pictures of old tiles, or you know giant rolls of shiny gold material. Somebody's grandmother died and they brought in a tote just filled with probably 20 years’ worth of scrapbooking stickers which it took like three days to sort through.

Jess echoes this, “I get parents that are like ‘hey I have some Legos at home, I hear you have Legos. Can I make a donation?’”

School librarians also describe “scavenging” for materials, such as Jenn, who asked for the sewing machines that were being excessed after the home economics program in the school was dissolved, and Ivy who describes asking for materials from the art teachers, and her friend who is a seamstress.

Almost half of the participants mention obtaining grant funding to purchase materials or furniture. Isabel explains:

I obtained most of the product we have in the makerspace through grants. One was a private community grant, another was a BOCES grant, so basically everything in our makerspace has been purchased through grants. I think we spent well over $5,000 to get started.

Diane notes “our librarian really took the reins of identifying tools and things that she wanted available in the makerspace, and she did a lot of the purchasing, and worked with our business official to find grants and funding sources for the library.” Sam noted the funding for the
makerspace came from grants through local politicians, as well as the state and federal
government. Tony noted that some equipment, such as the augmented reality sandbox, was
funded through a Donors Choose project².

Several interviewees indicate that obtaining items is something that requires continued
investment. Debbie says “you can't expect to configure it once and then that's it, and it's up and
running, and that's good forever. It needs TLC, you're always updating the materials, changing
things around, keeping it interesting, trying new activities in it.” Similarly, Ivy says “there's
always constant investment, so this isn’t a one and done.

Many participants remark that the makerspace can get messy because of the activities
occurring and materials being used, and report needing to find ways to store and organize
materials. For example, Matt notes “makerspaces can be kind of messy, and when you're trying
to maintain a clean environment, especially the library, and a brand-new library, it's very hard to
do that in that space.” Similarly, Patricia says:

I think it's difficult to keep them organized... sometimes it does get messy, and so a
visitor comes in and doesn't really get it, and it doesn't look impressive, even though it is.
So finding ways to keep those spaces organized and clean ... it very easily can start
becoming things everywhere, and so just trying to find a way to keep that structured and
organized because you want it to be aesthetically pleasing too, because people do feel
impacted by that.

Participants say that students are not always respectful of the space and materials, they do
not always clean up after themselves, materials get stolen or broken, and students waste or

² Donors Choose (https://www.donorschoose.org/) is a web based fundraising platform that allows educators to post
projects that individuals and organizations can provide funding for.
misuse makerspace materials. Ivy says “we had to figure out which materials were the problem. Like what would migrate, what would be used inappropriately and things like that.”

School librarians also report implementing various procedures to keep materials organized and usable. Maddie says, “It was a learning process, it was a lot of trial and error. It was this failed, this failed, until something worked.” Maddie described procedures such as checking materials out, which became time consuming for the library assistants. She notes:

Instead of having students sign things out, we would have them sign in at the desk and say they're here to do this activity. And then they were responsible for taking something off the shelf, but then returning it to that spot so labeling the shelves, teaching them where things go.

Sadie also recalls trying multiple procedures to help with materials management, and says:

It took a little bit of time for me to figure out the best way to handle that because I wanted them to be able to at any time request and have the items, I just had to figure out the right way to advertise that I had those items, but still have those items secured.

Sadie tried a few management techniques, noting that the one that worked well was putting empty boxes on display and having students bring the boxes to the desk to check the materials out. Similarly, Jess barcoded the robots, and students check them out at the circulation desk. She notes this also helps track what gets used and how often.

In addition to managing items, participants note that materials and equipment can malfunction or break. Participants specifically mentioned 3D printers and 3D pens, as well as more delicate items such as littleBits and Hummingbird robotics kits. Ivy notes “if you buy one of those maker pens guess what? They clog up. What are you going to do when that happens? Do you have any of your own abilities to fix things?” She goes on to say, “I’ve learned how to use a
wire stripper now for my hummingbird robotics because kids aren't careful with the wires and they break them.” Isabel also says that school librarians need to learn how to maintain and fix the items they purchase so they can keep moving forward. Matt similarly notes that maintenance of equipment is a concern:

The librarian is going to be responsible for maintaining that space. Making sure it's up and running, which is a huge daunting task when it comes to certain equipment, keeping it maintained, clean, well running so that it doesn't break.

Fixing and maintaining materials and equipment results in an increased workload for the school librarian in two ways, they have to learn how to make the repairs, and then have to make them. This may require formal or informal training, as well as an investment of time.

A majority of interviewees describe modifying or renovating the library media center to accommodate maker programs. In almost all cases, school librarians describe starting out with mobile makerspaces, or stations, where materials are brought out and put away when the activities are over. As the maker activities grew in popularity, some schools renovated the library to create a dedicated makerspace, while others continue to use a mobile or centers arrangement.

When describing the renovation process in her school libraries, Danielle says:

What we found was, it was really a lot of work, and it took so much time because we were tearing the whole library apart and starting over in a sense. We were taking all the books off the shelves. Librarians were weeding those books and what they were finding was that there were a lot of books that were never circulated, so they were getting rid of them and making space so that they could bring new things into the library.

Diane also mentions librarians weeding the collection:
We are removing many of the books, it required us to reflect and really pull the circulation data for what books have been taken out, and how often they've been taken out, and things like that. Our librarians were tasked with removing books that are not being utilized. They reduced their collection significantly to make way for the makerspace, and the different configurations for the school library.

As does Patricia:

[We are] literally taking out books and taking out shelves to open up the space to actually make space for a makerspace and other ideas... And so, in terms of the work for the library media specialist, one area is figuring out what are the things we want to keep, and what do we want to take away.

As indicated by participants, even in a funded renovation, the workload for school librarians and others who work in the library increased.

Danielle describes her librarians as wanting more mobile, reconfigurable furniture, and that they were able to rely on the facilities department to build much of what they envisioned:

We wanted [the furniture] to be collapsible, and on wheels so that you could push them aside. We also were able to get the facilities involved in this project, and they started to build us a lot of the things that we were envisioning.

Trinity notes that her librarian did most of the modification herself:

[She] is making [the space] her own, moving things, getting things done herself, as opposed to asking for them to be done. I think that with respects to support, you get a lot of it verbally, but no actions behind the words of support which can be a struggle.

Nearly every school librarian mentioned seeking out and participating in training opportunities related to making and makerspaces. In some cases, this involved organized training
events such as attending workshops or professional conferences, or enrolling in graduate courses.

School librarians also note seeking out professional learning communities, professional publications, articles, and books, and visiting libraries of those who had already implemented makerspaces. Obtaining necessary training increases the workload of a school librarian, particularly if they are attending training outside of school time. Other educators also note school librarians seeking training regarding how makerspaces operate, and visiting other school libraries with an established space. Danielle says:

> The librarian really needs to have that background in how to operationalize it, and how to make it work. It's not okay to just set it up and let it go, you have to facilitate it, so I think that training piece, that collaboration amongst schools and librarians is necessary.

She goes on to say:

> We spoke with people, we looked at [other libraries], we read a lot of books about it. … I think the success came from the fact that we collaborated with other school districts, and got to see their spaces, and we got a sense of what it was, and then we took it from there.

As noted previously, school librarians report needing to learn about the equipment and materials they were planning to purchase. For example, Jess notes

> I started with my comfort zone, and then every now and then I have to reach out and buy something new, and learn about it. Like Makey Makey. In the beginning, I was like ‘I don't know anything about Makey Makey’ so it forced me to do a little bit of research - learn about them, and then order them, get them in, and play with them.

Melanie also notes “I need to personally find more information. I need to do a lot of reading, find out what's out there.” Similarly, Patricia notes:
[Librarians] need to stay up to date, about new technologies, and new tools that students can employ in these spaces, and even staying up to date about how makerspaces look, and how they can function, and ways that they can be used.

Interviewees indicate that designing and implementing activities increases the workload for facilitators - they take an investment of time and effort on the part of the school librarian and other educators working in the makerspace. Ivy notes:

We would clear all the tables out of our classroom space, so the kids could sit on the floor and do their Spheros. Two hours later, we have a class coming so those tables are back so there's a lot of setting and resetting.

Emily runs a maker club before school, which means she needs to arrive at school early, set up the materials, run the club, then clean up after the sessions are over. Some participants note that they give up personal time to ensure projects get completed, for example Cindy spoke about a quilting project she completed with students in her internship, and says, “This weekend I get to put it all together and presented it on Tuesday to the high school. So you have to do a little bit on your own on the side.”

Nearly all participants report that they would like to create or see more purposeful and meaningful activities that students can engage with outside of open exploration or would like to incorporate more maker activities into the curriculum, whether it is the library curriculum, or through collaboration and co-teaching with teachers. Maddie notes:

one thing that I always wanted to do that I just never got around to was I wanted to put in place some kind of daily challenge or maybe weekly, but some sort of activity that the students could do if they wanted to, but not have to do, but have some kind of challenge available to them that got them thinking and doing stuff.
Jenn says she would like to find projects that are “purposeful, intentional makerspace projects where kids are working together to create” but says she has a hard time identifying meaningful projects “because I’m also teaching my classes, helping everybody do all the things.” Similarly, Tony says, “it's always way more work than you think it is when you plan. It takes a lot of planning, and then other responsibilities that all the people involved have in their day-to-day jobs and tasks.” Sadie reports wanting to bring more community-oriented projects into the makerspace “something that was thinking more, not just for ourselves, but also for reaching out to the community” and noted a series of projects she has planned for the future – but they take time and effort to research and compile. Ana notes that even unstructured maker activities create “more work for the librarian. I think, for the librarian, they have to be aware of cycles in their planning. And, I think, strategically bring out new resources for students and figuring out when that's appropriate to do.”

Isabel, Emily, and Emma are all on a fixed schedule in their buildings – they have a set schedule of classes that they teach on a regular basis. All three have incorporated maker activities into the library curriculum in small parts, however all three note there is not enough time to devote to maker programs. Time spent on maker activities in the curriculum means time not spent on other information literacy topics. Other participants note wanting maker activities to be embedded into the classroom curriculum – to become a more regular part of the educational experience. Sadie says “one of my challenges was figuring out terrific ways that the makerspace could be utilized in the curriculum.” In school libraries without a fixed schedule, this requires librarians to collaborate with classroom teachers to bring classes into the makerspace. It requires increased work for school librarians to find meaningful ways the makerspace can support
existing curriculum, then sell those ideas to classroom teachers. It also increases the workload of the classroom teacher with whom they collaborate.

Other educators interviewed more specifically acknowledge that implementing a maker program increases the workload of the school librarian. Ana notes:

[Librarians need to] balance [maker programs with] traditional needs. Because the librarian still needs to teach about researching, have formal classes in the library, and those kinds of things. How do you balance this happening at one end of the library, and this happening at the other end? So I think there’s a tug and pull that goes with that.

Matt says:

I honestly think that putting the responsibility of maintaining and running that makerspace on the librarian is a huge undertaking. They have so many things on their plates between all the other things that go into a library media center. I feel like that's one more thing. … our librarian is doing so many things - books, orders, helping teachers with integrating other technologies in their classroom. Just everything. It's starting to become so many things she has to keep track of it, so I feel like it's going to be a little overwhelming for her once everybody starts getting into using that space.

**Changing Financial Costs**

Participants in this study indicate that there may be financial costs to the school district, and the school librarian related to maker programs. These costs are related to obtaining materials, equipment, furniture, and storage solutions. Obtaining materials through the school budget sometimes results in increased financial cost to the school district. At the same time, most participants indicate that materials and equipment are purchased through existing budgets, which means that money is being spent differently. It also seems that school librarians are using their
personal money to obtain items. There may also be financial implications from renovating or modifying the library space. Providing training for school librarians and other members of the social system may also add a financial burden to schools – both in the cost of training, and in providing coverage or incentives to attend training. Librarians and administrators may need to change how budget lines are allocated, which may mean taking funding away from other programs or needs in the school or library. Administrators in this study indicate that they have provided financial support because they believe in the vision of the school librarian, however this is not the case for all school libraries.

All school librarians and most other educators mentioned purchasing materials from supply, equipment, or technology budgets, while some asked administration for additional funding, especially for more expensive items. For example Sadie explains:

I did have some money that I was able to use from my very healthy materials and supply budget that I was able to use for the makerspace. And if there were bigger ticket items that I needed I would usually ask for it to be budgeted for the next year. For instance, the 3D printer. I didn't get it the one year, but then I said I need to have $2,000 put into my equipment line for next year, if you don't mind, because I’d like to get a 3D printer. So that's how the bigger ticket items were obtained, just waiting, and then budgeting for it in that next school year.

Other participants note that administration increased budgets or provided one time funding once they saw the results of the makerspace. Ivy explains “the district provided each of us like a $2,000 budget to buy things for our libraries.” Similarly, Jenn said,

The superintendent at that time was extremely library supportive. I noticed that the circulation of the magazines had been completely down. The makerspace was very low
key the first year, it was just some totes with some activities. I made it my goal to be more purposeful with what things we put in the makerspace, make specific projects that kids could come in and work on. But I needed materials, so I asked the superintendent if I could get rid of our magazines and replace that budget with materials for the makerspace. She doubled the amount of money I was allowed to spend.

And Maddie said, “the principal increased my budget so that I could maintain it, year after year after year and continue to grow the makerspace.” Ana, an administrator, notes “we supported [the makerspace] with financial resources, materials, supplies.” Cindy says, “I know a lot of it is provided through the normal school budget.” Danielle says, “they use a lot of their budget for buying materials that the kids wanted,” and Debbie states “a lot of it was just purchased through the technology budget because I saw the value in what [the librarian] wanted to accomplish.” Ivy notes it is important to “have a budget for your consumables.” Isabel also mentions needing to adapt the budget process to ensure consumables are available. At the same time many of the school librarians make personal donations as well. They describe purchasing items they see at the store and bringing in materials from their homes. For example, Sophie notes:

I’ll bring stuff in from home, you know I’m cleaning out my craft closet and I’ll bring things in. My husband owns a business, and he has lots of small parts for his work, so he'll have excess parts, and I’ll bring those in.

Similarly, Sadie says:

Some items were things that I had from when my kids were little. I had all that stuff, so I brought it in. I was able to create a lot of the spaces in the arts and crafts items from stuff that I had already. I also got some items from doing product reviews.
Emma notes “there are things like the latch hook rugs. I saw them in Barnes and Noble. I picked them up myself. I mean, you do things like that.”

One participant noted that the school did not fund any of the maker items. Trinity says “we recently had a new media specialist come into the building who started by bringing in her own supplies.” She goes on to say that most of the materials and supplies in the makerspace in her library have “come out of pocket of the person that's actually getting the makerspace going, as opposed to the district's supply and funds.”

School librarians report trying several ways to organize and store materials including, bins, totes, new shelving, cabinets, and movable carts. In some cases, changes to the space involved the school funding a coordinated renovation. Matt says the renovation in his library was funded through a bond project. Danielle notes that as technology director, she and her librarians created a 21st Century Librarians initiative and wrote it into the district technology plan to obtain funding. Debbie describes renovating the library in her high school. She recounts:

I worked very closely with our librarian in terms of what it means to be a library in the 21st century. Basically, we gutted our library in terms of what it looked like from a traditional perspective, pushed the stacks back against the walls and use the center space to really build multi use spaces that were configurable.

Some librarians describe needing to purchase furniture for the space – such as Sadie, Ivy, and Jenn who mention purchasing furniture for storage, and Ivy and Emma who recount purchasing tables and chairs to accommodate maker activities. Ivy notes: “I bought tables that could flip closed, and chairs that could stack so we can clear space.” Similarly, Debbie notes bringing in more mobile furniture:
the first thing we did is we bought configurable furniture for the space and tables with whiteboards. We started to make it a warmer space where students wanted to come, so we got couches and chairs. All furniture that was configurable so that teachers could come in, students could come in, they can form little groups.

Administrators also note that it is important that they provide the resources for school librarians to engage in professional development. Providing resources may be a financial cost to the school in several ways. School districts may pay for training, pay for substitute teachers or additional support staff to free up time for the librarian, or pay for additional hours during out of school time for the school librarian to attend training. Additionally, many teaching contracts in this state stipulate increasing salaries based on training obtained through in-service programs or additional graduate credits.

Other educators note the importance of training other teachers in the building. Diane says, “make sure that all staff have training on what the potential impact could be, and how to integrate the makerspace into their curriculum.” Similarly, Matt says “know your audience and train your staff.” They believe this is important to ensure buy-in from teachers so that they will use the space. Training teachers and other staff may result in a financial cost to the school, however as indicated in the unanticipated consequences, oftentimes the school librarian conducts such training – thereby increasing their workload.

It seems that administrators in this study are willing to invest in maker programs in their libraries. Debbie notes:

I made sure that she had time to do what she needed to do. I would work with her administrators at the high school to make sure that she was freed up to do things that she felt were important in order to set the space up, and also for her own professional
learning. Over the summers I made sure that she had access to the courses she needed, that she was given credit for those courses, that we could pay for those courses, to make sure that she could stay on the forefront of what was happening with makerspaces. The types of material she wanted to explore, the types of technology she wanted to bring in. So, in terms of time for those, we made sure that everything was carved out so that she had that time to do what we needed her to do, and what she wanted to do.

Similarly, Sam says “as far as financing and supporting the program, and professional development opportunities, we are willing to do anything, at whatever cost that may be.”

**Risks**

The results indicate that there are risks to implementing maker programs. These risks revolve around safety, financial ramifications, and failure of the program. Half of the librarians note potential safety concerns associated with some maker activities, such as injuries from glue guns, irons, and power tools. At the elementary level, there is a risk that students will put objects in their mouths, or that parts of projects such as batteries and latex balloons may be a risk to the students’ families if brought home. School librarians note considering risks associated with a project or equipment before purchasing or introducing it to their students. Maddie notes:

> There were certain projects that had risks. Like when I did perler beads and I taught the kids how to use an iron, that was risky, and I ended up not having them iron after all, because it was too much.

Additionally, Matt notes:

> one of the risks is it's expensive stuff, and it gets broken, and then it doesn't get replaced, and that can lead to the failure of the space. [For example], we had all this equipment, half of its broken, and we don't have the money to fix it, or we have to wait until the next
budget season to fix it, and then everybody kind of falls out with it, and is like ‘ah, we
don't want to do that anymore.’

Participants note a risk that equipment or materials will be purchased that students do not
use, or that are not compatible with existing technology. Jenn notes “sometimes I buy something
then no one touches it. That's the biggest risk, something's going to be a bust.” Similarly, Sadie
notes “I think the biggest thing is money spent that you might not see right away that students are
utilizing it.” Sadie also identifies that some materials associated with makerspaces are either not
compatible with existing equipment, or do not conform to EdLaw2d3. Sam notes the risk of not
adequately planning for a maker program. He says “just putting the space there and not having
the instructional plan or curriculum plan to move forward” is a mistake. He goes on to explain
“as much as we throw money at making a space, if there's not a true instructional vision plan, it
just sits there and collects dust.”

There is a risk of failure due to burnout, failed activities, lack of support from the social
system, and lack of qualified staff. Emily notes that by the time the end of the year comes she is
counting down the number of sessions “because you know it kind of wears on you, after a while.
It's exciting it first and then it's like ‘oh God.’” Trinity notes risks specific to the school librarian,
“out of pocket money, and the investment personally from the people, investing in the space. For
that not to be you know returned in some way.” Tony notes that “there's always the risk that if
something doesn't go well, will you lose the buy-in from your colleagues. If something flops,
will they if I try it again? Will they come back, or will it end up being a waste of time?”

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3 EdLaw2d is a student data privacy law in New York State that prevents the unauthorized release of personally
identifiable data for students and educators. It requires schools and technology companies to enter into privacy
agreements if personally identifiable data is shared with the technology company – such as in creating accounts for
students.
There is also a risk that schools will not be able to find a school librarian with the skills and dispositions to successfully run a maker program. It seems there may be something about the librarian that allows for a successful maker program. Patricia says:

I've been in two districts where it's been successful, and you know in some ways the space sold it, in some ways the library media specialist helped sell it. I think, in the end it has to be a little bit of both, but the library media specialist is in charge of creating the space that invites that, and that enable that to happen.

When recounting deciding to create a maker program, Ana said:

We were at the point where we were hiring a new librarian, and so we had the opportunity to create a new vision for the district. We were reading about more of an interactive library space versus a traditional library space, and we also did some visitations of some libraries that were more setup with a makerspace. All of that went into the decision making, and also making sure that we hired someone that was enthusiastic about that as well.

Trinity notes:

[A makerspace] was something that was wanted by the administration, but previous media specialists that came in didn't know where to start or where to begin, so they kind of let things just lie. We recently had a new media specialist come into the building who started her creativeness by bringing in her own supplies, by asking for people to contribute, by asking for students to try, which opened up the door to lots of innovation.

Darcy indicates there is a shortage of librarians who can operate maker programs, which stopped the district from creating them in other schools:
[There] was a shortage of librarians. We couldn't hire anybody to really be a partner to [our high school librarian] and do the work in the other schools, so that was a big piece that prevented us from moving forward in the other buildings.

Matt notes the risk of the program collapsing if the librarian leaves, and suggest training teachers would help alleviate that risk:

You get a librarian that is an expert in [maker programs]. When they're gone and nobody's there to kind of pick up that mantle, now who does it? So training other teachers on how to use it and how to maintain it is really important.

Cindy indicates the need for anyone working with the librarian to have the skills and dispositions as well:

I think for the librarian to be successful with implementing makerspace she needs someone working with her that understands all the makerspace activities. I think the roles have changed for the library clerk. I think the library clerk really needs to get involved in there, or it's just too overwhelming for the librarian.

Another risk is the possibility of disappointing students. This can happen because of lack of space, time, staffing, or materials to accommodate all students. As indicated in desirable consequences, creating maker programs in school libraries increased student usage in almost every library. One of the undesirable consequences noted by many participants is that the increase in student interest and use of the library led to disappointed students, as they were unable to accommodate all who wanted to use the maker materials. Maddie notes,

Students came to the library in droves. We actually had to turn students away at some point, because there's a maximum capacity that we had to maintain, and at peak we would
have 75 to 80 kids in the middle school library. We had to limit the amount of lunch passes they could have which they would get upset over.

This is echoed by Jess who said, “everybody wants to come down to the library and everybody can't come to the library, because I can only have 102 people in there at a time. So, that's a bit of a problem.”

At the elementary levels, school librarians note similar challenges. Ivy said,

When we have our maker classes - the coding classes and robotics classes - happening, it's not open to everyone. It's teacher selected. So occasionally I’ll have students come up and be like, ‘how do I get into that class?’ and I explain you need to be selected by your teacher, sorry. And that's no fun.

Similarly, Emily who runs a maker club says,

Kids are really into this. I try not to turn away kids so that's actually a problem that goes back to time. I allow two sessions of five meetings for each grade level. And that's just so I don't have to turn anybody away. I started with one session, eight weeks, and you end up with 40 kids. I don't have enough material or space to handle that.

Ivy also noted that when she ran a maker club she had to limit it to 22 students because of a lack of space.

Despite the risks, some participants believe the biggest risk is for non-adopters. Darcy says:

I think that we risked more by not having a space than having a space, because by not having the space we really have left our students at a disadvantage for not having access to resources they need to be present and competitive. It really supports problem solving, creativity, ingenuity, innovation, so I don't see any risk with having the space.
Chapter 5: Discussion

This study finds that maker program adoption is driven by school librarians’ beliefs about the benefits of maker programs, which have been formed by interactions with their communication channels. Further, implementing a maker program results not only in the benefits anticipated, but may address wider social and educational concerns. Implementing a maker program affects the entire social system of a school, and has implications for society as a whole. At the same time, the results indicate that a successful maker program requires more than an investment in tools and materials, that the personality characteristics of the school librarian also play an important role.

For participants in this study maker programs hold relative advantage over existing practices in the library and school – the compatibility of maker programs to address felt needs or problems in the library or school outweigh the costs. Maker programs have varying levels of complexity, as well as trialability. The flexible nature of maker programs in terms of materials and potential activities allow adopters to try small, less complex activities and materials before full implementation. This decreases uncertainty and allows educators to reinvent maker programs to meet the needs of the schools and libraries where they are implemented, which increases sustainability of the innovation over time. Finally, the observability of the results of implementing maker programs has led participants in this study to confirm their decision and continue adoption.

The results also indicate that implementing a maker program allows school librarians to enact all of the roles assigned to them by the American Association of School Librarians: teacher, instructional partner, information specialist, program administrator, and leader.
Drivers

This study identifies school librarians’ beliefs and perception about maker programs as the main driver of adoption. However, the results show that this is not a straightforward driver and understanding it requires elaborations on three main ideas.

First, the results of this study indicate that maker programs are a grassroots effort, and school librarians are key players in the decision to adopt such programs in their libraries. Although previous literature indicates that the adoption of innovations in schools is often a top-down initiative or an authority decision (e.g., A. M. Sidorkin & Warford, 2017), in the case of makerspaces in school libraries, it is librarians, moved by their beliefs and perceptions about makerspaces, who initiate the process of innovation. Thus, instead of using an innovation whose adoption has been decided by others (someone in a position of power, like an administrator or a policy maker), the school librarians in this study took initiative and made the decision about starting a makerspace. This bottom-up approach to makerspace adoption has also been acknowledged by previous studies. For example, Harron and Hughes (2018) indicate that “makerspaces are largely being added to schools by librarians and teachers who are passionate about the topic” (p. 256). This may indicate that the type of innovation may determine who initiates the process of adoption. It may also indicate that strong beliefs about the benefits of the innovation may result in a greater push at the grass roots level for the adoption of such innovations.

Actually, the results show that these beliefs served as the main driver in the decision to adopt such programs. Librarians had strong perceptions of the anticipated benefits of
makerspaces. Although identified as three distinct types of benefits – for students, for the library, for the school – they are highly interconnected.

First, librarians perceived benefits for the students. Librarians believed that a maker program would increase students’ social emotional skills related to self-awareness, self-management, relationships, and responsible decision-making. They also believed that a maker program would change perceptions about the school library among stakeholders, transforming it into the hub of the school. Finally, they believed maker programs would support student learning by increasing resource access and utilization, supporting and extending the curriculum, and by providing opportunities for students to learn in different ways. These findings suggest that school librarians are adopting maker programs because they have implications for the entire school community.

Opportunities for students to develop social emotional skills was the most prominent benefit school librarians were anticipating. It seems that school librarians place high value on social emotional outcomes for their students and believe supporting such outcomes will lead to other changes as well. The most frequently mentioned social emotional skill was self-awareness. School librarians in this study wanted to provide opportunities for students to discover their passions and interests, develop a growth mindset at they worked through challenges, and gain confidence as they experience self-efficacy – recognizing their own abilities. This finding indicates school librarians are concerned with how students view themselves as individuals, and as learners. They feel strongly about giving students voice and choice in their educational experience, which they believe has an effect in other areas of students’ education and lives.

The second most frequently mentioned competency was the potential to develop responsible decision making skills – including problem solving, critical thinking, curiosity and
open mindedness, and making reasoned judgements after analyzing information (Collaborative for Academic Social and Emotional Learning, 2020). These are the same skills outlined in the National School Library Standards for Students – they are what librarians are responsible to teach (American Association of School Librarians, 2018a). They are also skills often associated with maker programs (Dougherty & Conrad, 2016; Honey & Kanter, 2013; Hughes, 2017; Martinez & Stager, 2019), including in practitioner literature (Canino-Fluit, 2014; DelGuidice-Calembo & Luna, 2017; Fourie & Meyer, 2015). Previous literature on maker programs suggests that the curriculum should be “a primary factor for developing a makerspace” (Julian & Parrott, 2017, p. 15), and that making should be viewed as an integral part of the curriculum, not an add-on (Harron & Hughes, 2018). It seems that school librarians saw an alignment between maker programs and their curriculum, which leads to greater sustainability over time.

Developing relationship skills was the third most prominent perceived benefit. School librarians felt that implementing a maker program would allow students to work together, build relationships, and learn to communicate with each other. Concerns have been raised about how technology has changed youths’ ability to communicate in a face to face environment (Uhls et al., 2014). There are also concerns about the psychological effects of social media usage among youth including depression (Shensa et al., 2017) and social isolation (Primack et al., 2017). It seems that school librarians share these concerns and believed a maker program would be one way to mitigate the negative effects technology has had on society.

The second most prominent set of beliefs revolve around benefits for the school library, which is realized through an increase in social awareness. School librarians believed that a maker program would improve social awareness by allowing students and teachers to recognize the resources and opportunities available – they believed that adopting a maker program would
change perceptions about the school library. That school libraries are often seen as antiquated and unnecessary is not unknown (Loertscher, 2012; Wong, 2013), and is attributed to a lack of understanding about what a school librarian does (Ewbank & Kwon, 2015; Johnston, 2012; Lewis, 2020). School librarians believed that a maker program would allow them to showcase how the school library could support students beyond providing books. This benefit for the library is related to benefits school librarians believe maker programs provide for the entire school community.

School librarians believed that maker programs could benefit the entire school community as they would provide access to tools – including technology – and experiences that students are missing in other parts of education, and in their lives outside of school. The multitude of responses indicating that there are experiences missing from the existing school curriculum – specific skills and types of learning experiences – or that students need to be provided opportunities to engage in activities that are not related to their coursework is in direct contrast to previous literature (Harron & Hughes, 2018; Hira et al., 2014; Julian & Parrott, 2017). The results show that some school librarians are adopting maker programs because they align with existing curriculum, but some are adopting because they address what is missing from students’ educational experience. Together, the three types of benefits school librarians believe maker programs provide – for students, the library, and the school community – implies school librarians believe maker programs help address a variety of educational and societal concerns.

Second, it seems that school librarians’ strong beliefs were the results of unspoken peer pressure. Previous research suggests that unspoken peer pressure – the idea that everyone else is doing it – makes an innovation more likely to be adopted (Sträub, 2009). The results actually indicate that peer pressure, often reflected in the visibility given to school libraries’ makerspaces
in the practitioner-oriented literature (e.g., Daley & Child, 2015; Fontichiaro, 2016; Fourie & Meyer, 2015; Graves, 2014; Graves et al., 2017; Loertscher et al., 2013; Moorefield-Lang, 2018; Preddy, 2013; Seymour, 2015; Smay & Walker, 2015), plays an important role in the decision to adopt makerspaces in NYS and that this institutional isomorphism is mainly driven by a desire to stay current and relevant. Yet, the results also show that once makerspaces have been adopted, librarians are able to see the positive results themselves, which sparks further investment in makerspaces and therefore guarantees their sustainability over time.

Finally, the results show that the adoption of makerspaces can be framed as incremental change processes instead of radical change processes. In this respect, the school librarians in this sample were able to start small, with one or two activities and build on them before they made a full commitment to maker programs. Being able to try the innovation allowed school librarians to see the results and confirm their decision to adopt maker programs. Previous studies have also confirmed the importance of incremental change in relation to innovation in school settings: educators look for changes in students outcomes before they begin to change their attitudes and beliefs about teaching and learning, and ultimately when deciding whether or not to continue a new practice once implemented (e.g., Guskey, 1986).

**Consequences**

Overwhelmingly, this study shows that maker programs in school libraries produce the desirable consequences anticipated. Further, the results seem to indicate that there are many more desirable consequences that were not anticipated. The results also indicate that many of the consequences are indirect – they do not happen as a direct consequence of adoption, rather as a chain reaction. Finally, this research shows the positive impact of makerspaces is broad and includes changes in perceptions, resources availability, and skills. At the same time, there are
undesirable consequences related to maker programs including increased workload, changing costs, and increased risk, yet participants in this study chose to continue adoption, suggesting that the benefits of makerspaces outweigh their costs and challenges.

**Anticipated and Desirable**

It seems implementing a maker program starts a chain reaction of indirect desirable consequences. This study shows that maker programs support the development of students’ social emotional skills, which is possible because they change perceptions about school libraries, which allows school librarians to better support learning. The results show that maker programs in the school library change perceptions among stakeholders about what a library is, and what it provides. Additionally, they change perceptions about learning and school for teachers, administrators, and students. Maker programs lead to an improved image for the library and school, and improved climate in the school library, which lead to increased usage of the library by students and teachers. These changes allowed school librarians to better support student learning in three ways: maker programs lead to increased resource availability and utilization, new collaboration opportunities with subject area teachers, and improved relationships between educators and students. Together, the anticipated and desirable consequences suggest that maker programs in school libraries may be an effective way to build resilient students, serve as a safe space, decrease drop out by students considered at-risk, and serve as a conduit to develop talents needed to address current and future societal problems.

First, and most predominantly, the results indicate that maker programs allow students to develop a wide range of social emotional skills. The most prominent social emotional competencies noted by school librarians and other educators in the school are responsible decision making and relationship skills. The third most prominent social emotional outcomes
mentioned are related to self-awareness. The results of this study indicate that school library-based maker programs offer the same outcomes identified in maker programs in other setting (Bar-el et al., 2016; Barton et al., 2016; Bevan et al., 2015; Bowler & Champagne, 2016; Holbert, 2016a; Schrock, 2014). It seems that the need to meet school building and district goals does not change the social emotional outcomes for participants in a school library-based maker program. Further, the results indicate that maker programs in the school library support the same social emotional skills that have been identified as important to addressing societal problems in the 21st century (Olszewski-Kubilius et al., 2016), and may be one way to identify and nurture untapped potential (Mersand, 2021b). At the same time, although self-awareness competencies are noted by most school librarians, they are hardly mentioned by other educators in this study. It may be that other educators are not as involved in the maker program, so they have not witnessed all of the outcomes that occur.

Second, the results indicate that makerspaces are revitalizing school libraries and bringing them back to life. This suggests that makerspaces in school libraries may help keep them relevant, as Loertscher (2012) and Wong (2013) suggest, as well as change perceptions of their role as a quiet book repository meant for research and studying (Ewbank and Kwon, 2015). Maker programs help transform libraries into the hub of the learning community. Maker programs improved the image and climate of the school library, and students have come to view the library as a safe space in several ways – to relax, reset, and also to take risks. Merga (2020) suggests school libraries serving as safe spaces is important for students’ emotional well-being. School librarians and other educators indicate maker programs led to better relationships between educators and students, as well as more positive relationships among students through collaboration and communication, which helps students feel a sense of belonging – both in the
library and in school. This sense of belonging allows students to feel ownership over the space, and ultimately over their learning. A sense of belonging has been identified in previous literature as an important factor in the outcomes from maker programs (Barton et al., 2016; Bevan et al., 2015; Holbert, 2016a; Schrock, 2014). It has also been identified as key in developing resilient students, and decreasing drop out for those considered at-risk (Jones, 2009). It is possible that students engage in school library makerspaces on a more regular basis than they may be able to engage in a community-based makerspace or maker program outside of school. It is also possible that school library-based programs make these experiences available to a wider population of students due to their accessibility. Together, this suggests that school library maker programs may be better positioned than other types of maker programs to build relationships between peers through more sustained interactions.

Third, a direct consequence of implementing maker programs in school libraries is that they have increased access to and utilization of materials, equipment, and other resources for independent exploration, as well as to support and expand existing curriculums. Although makerspaces in the adult community have been criticized for being dominated by wealthy white males (Bucheley, 2014), and concerns have been raised that maker programs may be widening the digital divide (Hughes & Morrison, 2018), the results of this study indicate maker programs are decreasing some educational divides. At the same time, resource availability has impacted how teachers utilize school libraries, and school librarians. Maker programs, and the resources available, have opened doors to new collaborative opportunities between school librarians and classroom teachers, which has been identified as a gold standard in school library instruction, and a focus of larger school reform (Kimmel, 2012). Maker programs are allowing school
librarians to enact their roles as instructional partners and leaders to better support student learning, further changing how stakeholders view the school library program.

**Unanticipated and Desirable**

In addition to the anticipated and desirable consequences, there have also been desirable consequences that were not anticipated, indicating that implementing maker programs has more far-reaching effects than initially considered. Some participants had not anticipated collaboration between students, some had not anticipated that collaborative opportunities between the librarian and teachers would arise. One participant was surprised at how well received the maker program was in a high school library. Two additional desirable, but unanticipated consequence of implementing maker programs are a change in attitudes and beliefs of the school librarian and other educators in the school, and that school librarians found themselves positioned as change agents.

First, the results suggest that some school librarians in this study experienced a shift in their beliefs about librarianship – implementing a maker program helped them to shift from a facilities-oriented sense of librarianship – concerned with maintaining the facility with rules and procedures, to one that embraces a noisy participatory environment where students have a say in what happens in the library (Phillips et al., 2019). The results of this study show that school librarians and other educators changed their beliefs about teaching and learning as they learned more about maker programs and saw the results – they also changed their attitudes as they learned to let go of control, to take risks, and to embrace change. School librarians and other educators perceived that maker programs lead to desirable changes in student outcomes – and they found what they believed was concrete evidence of changes. In line with research on teacher change (Guskey, 1986), this evidence helped them to change how they view teaching and
learning from a behaviorist stance – where the teacher is in charge and directs the learning experience – to a constructivist stance – where the student has more freedom and the teacher acts as a facilitator. Similarly, teachers learned how to better collaborate in a co-teaching situation, and school administrators shifted their beliefs about student accountability and freedom for students to make choices about their educational experience.

Second, school librarians in this study found themselves acting as change agents, in their schools and districts, and also in the wider community. School librarians acted as change agents within their schools, encouraging teachers and students to use the maker programs they created. School librarians act as change agents in the local community – as other cultural institutions turn to school librarians to learn about maker programs. Finally, school librarians act as change agents in the wider educational community – acting as champions of maker programs in a variety of venues: training other librarians, teachers, and administrators about the innovation. It seems maker programs have allowed school librarians to enact their leadership role. Teachers, and specifically school librarians acting as change agents within their libraries and schools is not unknown (Buddy, 2006; Oberg, 2009), however acting as change agents outside of their schools is not previously documented. This research indicates that school librarian’s role as change agents in STEM education goes beyond being an information resource and partner, as suggested by Subramaniam, Ahn, Fleichmann and Druin (2012).

**Anticipated and Undesirable**

Although the results of this study show that there are a multitude of desirable consequences from adopting maker programs, this study also highlights undesirable consequences, something Papavlasopoulou, Giannakos, & Jaccheri (2017) indicate is missing from makerspace research. This study shows that implementing a maker program leads to
increased workload – particularly for school librarians – changing financial cost for the school and librarian, and increased risk. These consequences are related to obtaining, managing, and maintaining materials, and equipment, modifying or renovating the library space to accommodate maker programs, training, and designing and implementing activities. At the same time, these undesirable consequences seem to lead to an additional indirect desirable consequence – school librarians have found creative ways to overcome challenges. Further, the undesirable consequences uncover that there may be something about the school librarians’ attitudes that lead to maker program success.

First, although the most prominent undesirable consequence of implementing maker programs is an increased workload for the school librarian, only one librarian participant expressed that this workload was potentially undesirable to them. It seems that other members of the social system – teachers and school administrators – more readily acknowledge and are concerned that maker programs add additional responsibilities for a school librarian. The results show that participants in this study believe that maker programs hold relative advantage – over traditional libraries, and ways of teaching. Rogers explains that relative advantage is “a ratio of the expected benefits and the costs of adoption of an innovation” (p. 233). Despite the undesirable consequences of adoption, participants believe that the benefits (desirable consequence) outweigh the costs (undesirable consequences). Participants in this study believe maker programs are compatible with felt needs or problems in the school, and addressing those problems is worth the investment. Previous research shows that those who are sufficiently invested in an innovation, those who have strong beliefs about the benefits it holds, will find ways to overcome barriers (Armstrong, 2019; Edwards, 2015; Ertmer et al., 2012). The undesirable consequences of implementing maker programs lead to an indirect desirable
consequence - school librarians in this study are finding ways to overcome challenges through creative problem solving.

School librarians in this study are starting maker programs with lower cost activities and materials that are easily supported by existing budgets, and have engaged in creative problem solving – identifying alternative ways to obtain materials and equipment including through donations, grants, and fundraising efforts. When physical space is not available for a dedicated makerspace, school librarians are adapting the concept of makerspace to incorporate maker activities, which is in line with Moorfield-Lang (2015). School librarians are also finding creative ways to manage and organize maker program materials by modifying existing spaces and trying different strategies until they find the right one for their school. When there is not time to incorporate maker activities into the curriculum, school librarians are creating before and after school programs to allow students to participate. It seems that school librarians have garnered administrator support, as administrators in this study report they are allocating resources for the maker programs because they too are sufficiently invested. Scholars have noted that reinvention – that an innovation is adopted but modified to fit the social system – is important, particularly in education (Guskey, 2020; Sansom, 2017; Warford, 2017).

Another way school librarians have overcome challenges is through their information seeking behaviors. This study shows that school librarians seek information related to all three types of knowledge identified in Rogers’ theory – awareness, how-to (how does it work), and principles (what an innovation is supposed to do). They have become aware of maker programs through graduate courses, workshops, professional publications, and professional learning networks. School librarians and other educators have sought how-to and principles knowledge through the same channels and have also visited established school library maker programs to
learn more about how to create and maintain such programs in their own libraries. Harron and Hughes (2018) suggest that training is a form of trialability for maker programs, as it allows participants to try the innovation before committing to adoption. At the same time, much of the principles knowledge seems to come from actual implementation of such programs – seeing the results. Indeed, Guskey (1986) suggests that training is not enough to result in change. This study also reveals that providing training to other members of the social system about maker programs helps ensure their success. Educators must be trained, adopt the new way of teaching and learning, and see a change in student outcomes before they change their attitudes and beliefs (Guskey, 1986). At the same time, this research identified a lack of information resources available to school librarians and teachers related to planning and implementing maker activities.

Second, the results of this study reveal that personality traits of the school librarian may play a role in maker program adoption. Further, the school librarian’s attitudes may be a crucial factor in the success of a maker program. In line with Rogers’ generalizations about earlier adopters (Rogers, 2003, pp. 289–290), it seems participants in this study have greater empathy as they describe implementing maker programs specifically to meet the needs of students, and there is indication that these school librarians are listening to students’ voices when making decisions for their library programs. Participants in this study appear to be less dogmatic and have favorable attitudes toward change as they were willing to let go of the traditional views of what a school library is and does. Participants in this study appear to be able to deal with abstractions and have greater rationality as they problem solve and reinvent maker programs to fit their needs and environments with what they describe as limited resources for activity development. Participants in this study appear to be able to cope with uncertainty and risk and are less fatalistic – despite the challenges and potential risks, participants were willing to let go of control, and try
a variety of ways to overcome challenges rather than giving up. Phillips et al. (2019) indicate that a school librarian’s sense of librarianship is defined by their understanding of the profession including beliefs about the types of roles and responsibilities they have, the kinds of activities and experiences that are appropriate for students in the library, and beliefs about the roles students should play in the direction of the library. It seems that participants in this study are on the participatory, noisy, student-centered end of the spectrum of librarianship. It seems that school librarian’s attitudes have a direct impact on the success of a maker program.

**Unanticipated and Undesirable**

This study did not uncover any undesirable consequences that could not be reasonably considered unanticipated. It seems that participants in this study are willing to take on an increased workload, changing financial costs, and are willing to take risks based on the beliefs they hold about the benefits of maker programs in their libraries.
Chapter 6: Conclusions

This research explores the diffusion of innovations in school libraries using the case of library-based maker programs in PreK-12 public schools in NYS. The goal of this study was to better understand maker programs in school libraries through an analytic framework that uses Rogers’ diffusion of innovations theory. This study had two research questions:

R1: What drives the adoption of maker program in school libraries?

R2: What are the consequences of implementing maker programs in school libraries?

In terms of drivers, this study identifies school librarians’ beliefs and perception about maker programs as the main driver. The observability of maker programs acts as the second driver. The observability of the results other school librarians experienced influences school librarians’ beliefs, and they adopted maker programs because they wanted the same benefits for their students. As school librarians saw beneficial results for their own students, they expanded their programs.

In terms of consequences, this study identifies seven desirable consequences of maker program adoption many of which are indirect, and two of which were unanticipated. Incorporating maker programs resulted in increases in students’ social emotional skills, particularly in the areas of responsible decisions making, relationship skills, and self-awareness; changing perceptions of the school library, which lead to improved climate in the library, and increased usage of the school library by students and teachers. Implementing maker programs allowed school librarians to better support student learning through improved resource access and utilization, improved relationships with students, and increased collaboration with teachers to support and supplement the existing curriculum. Additionally, implementing maker programs lead librarians, teachers, and administrators to adopt more student-centered practices – they
learned to let go of control. Implementing maker programs also positioned school librarians as change agents, both in their schools and districts, as well as in the wider community. This study also identifies three main undesirable consequences from implementing maker programs, each of which could be reasonably considered anticipated – increased workload for school librarians and others in the school, changing financial costs for the school and librarian, and increased risk – related to obtaining, managing, and maintaining materials and equipment, designing and implementing activities, renovating or modifying the library space, and training.

Further, implementing a maker program allowed school librarians in this study to enact each of the roles assigned by the American Association of School Librarians. Maker programs allow school librarians to act as program administrators, information specialists, teachers, instructional partners, and leaders.

**Contributions**

This study set out to address three gaps and in doing so makes several contributions. First, this study extends the emerging research on maker programs. Existing research on maker programs is largely focused on settings other than school libraries. This study is among the first to examine maker programs in school libraries. Therefore, the findings contribute to what is currently known about maker programs.

Second, this study identifies what drives school libraries to implement maker programs. In doing so, it uncovers important characteristics of the innovation, the organization, and the individual that affect adoption. Further, the results reveal that the type of innovation may determine who initiates adoption, and that strong beliefs about benefits may affect grass roots level adoption of innovations. Finally, the results indicate that maker program sustainability may be closely tied to the purpose for adopting.
Third, this study identifies the consequences of implementing maker programs. This results in several contributions. First, the results reinforce that when there is a close match between what adopters expect, and the results of implementation, they will confirm their decision to adoption. This research adds that implementing maker programs is more complex than the adoption of other innovations such as a new piece of software, or a new piece of equipment. Third, this study is among the first to consider the undesirable consequences of implementing maker programs. Although the undesirable consequences found can reasonably be anticipated, this research uncovered ways that school librarians have overcome undesirable consequences to create successful maker programs. Fourth, this research reveals that there are characteristics of makerspace facilitators, including attitudes, beliefs, experience, and training that impact maker program success. Further this research uncovers that not only is specialized training for school librarians an important component of maker program success, specialized training for teachers is also necessary. Fifth, this research shows that the effects of implementing maker programs are often indirect, and far reaching – maker programs have consequences for students, school librarians, school libraries, and the school as an organization. At the same time, they have the potential to address larger societal problems. Finally, implementing a maker program in the school library allows school librarians to enact each of the roles assigned to them: teacher, instructional partner, information specialist, program administrator, and leader.

**Results and Research Implications**

The results of this study uncover seven avenues for future research in schools, school libraries, and maker programs. First, this research revealed that social emotional skills development as one of the most prominent anticipated and realized desirable consequences of implementing a maker program. Further, it seems that school librarians believe developing social
emotional skills has effects on other areas of students’ lives. Although participants in this study shared activities and experiences from their maker programs, and this study uncovered a variety of desirable outcomes, this research did not focus on the purpose or structure of the activities, or how the purpose and structure influenced the outcomes. Previous research has often attributed maker program outcomes to the technologies available in the spaces, however the results of this study indicate that it may not be the technology, but the learning environment created that leads to outcomes. Future research should examine what allows for the development of social emotional competencies in school library maker programs. Further, research should examine how developing social emotional skills influences other student outcomes, including academic and behavioral outcomes. Finally, this study may serve also as a starting point to develop formalized measurement tools for maker program outcomes.

Second, this research uncovered that maker programs may be one way to address larger societal concerns. More could be learned about how school library maker programs contribute to student resilience, mitigate the negative effects of technology use, and help build skills needed to address 21st century problems in society. Further, the results indicate that school libraries serve as a safe space for students. More research is needed to understand what safe space means to students, and how school libraries, classrooms, and schools can operate as such.

Third, the results indicate that school librarians’ personality characteristics may play a role in the types of library spaces they create. It also uncovers that maker programs can change the attitudes of school personnel about teaching and learning. More can be learned about how personality characteristics contribute to the purpose and structure of maker programs, and school library programs in general, which may affect how others in schools view libraries, teaching, and learning.
Fourth, the results indicate that maker programs revitalized school libraries, transforming them into the hub of the learning community, with increased usage by students and teachers. They have also enabled school librarians to enact each of the roles as prescribed by the American Association of School Librarians. It seems that implementing maker programs served as an advocacy tool for school librarians to garner social system support. Yet, maker programs may not be the only innovation that can revitalize school libraries. Future research should examine which characteristics of maker programs lend themselves as effective advocacy tools with other members of the social system – what drove students and teachers to decide to use them. Such research could inform the adoption of future innovations in school libraries. Further, such research could inform teaching practices in more traditional classroom settings.

Fifth, this research uncovers that implementing maker programs has positioned school librarians as change agents – in their schools, districts, communities, and in the wider educational world. More could be learned about how school librarians can harness this new found voice to inform advocacy practices of school librarians for their programs, and also how this voice can be used to inform other educational practices in general.

Sixth, this research uncovers the need to provide appropriate training for school librarians and teachers to implement successful maker programs, however what that training should look like is not examined. Future research could examine what early adopters of maker programs in school libraries believe are the essential skills, competencies, and knowledge needed by later adopters, which could inform both research and practice.

Finally, much previous literature on diffusion of innovations in education are studied at the individual school level – how innovations spread within a particular school. Little attention is given to the fact that educators are a part of many different social systems, which effect
innovation adoptions. This study shows that innovations in school libraries diffuse between schools and districts. School librarians, unlike classroom teachers, are often the sole individual in a building with the job title. They do not have others in the building that they can observe or go to for new ideas and must seek out best practices from outside of their school. The same can be said for other special area teachers as well. More could be learned about how membership in different social systems affects innovation adoption in schools and school libraries.

Limitations and Research Implications

This study is not without limitations, which offer additional implications for future research. First, this research relied on survey and interview data, both of which have limitations including sampling error, non-response error, and measurement error (Dillman et al., 2014). The survey and interviews are both self-reported and may reflect inaccurate or misleading answers. It is possible participants throughout the study attempted to look more accomplished. Although the use of open ended, non-leading questioning techniques helped address this concern, more in-depth case studies involving direct observation of maker programs in school libraries may provide more objective information about maker program consequences.

Second, non-participation was a serious threat in this study. Teaching, particularly in public schools, became increasingly complex during the COVID pandemic (Gawronski, 2021), with a large amount of faculty and staff turnover, increased responsibility for additional roles of all school personnel (Chervinksi, 2021; Dos Santos, 2021; Lieberman, 2021), and school librarians in particular (Ahlfeld, 2020, 2021; Luetkemeyer, 2021; Morley, 2021), as well as the need to pivot to remote teaching when conditions warranted. The COVID pandemic forced school librarians to adopt innovations such as eBooks, electronic information sources, and virtual chat services at an unprecedented rate (Luetkemeyer, 2021; Zirogiannis, 2021), and in many
cases, completely changed their practice (Morley, 2021). In some cases, the school librarians were unable to utilize the makerspaces they created, as the school library had been repurposed into classrooms to accommodate social distancing. Similarly, participants noted that for the first part of the pandemic, maker activities were not made available due to health and safety concerns.

It had been anticipated that school librarians and other school personnel with additional responsibilities would not have time to participate in interviews. In total, ten individuals approached for interviews did not participate - two school librarians declined (one because they felt they had little to contribute, one because she was too busy); two agreed to participate but did not follow up with dates and times they were available; two did not respond to invitations to participate. One teacher, two building administrators, and one district administrator did not respond. This limitation was addressed by contacting additional school librarians and other educators until ten participants fitting each profile had been interviewed. Utilizing within-case snowball sampling, as well as researcher professional contacts helped to ensure the minimum 20 participants were identified.

This study relies on the perceptions of school librarians, and other educators in a school who believe that maker programs are having a positive effect on students. Although an effort was made to include a variety of other educators’ perspectives, only one classroom teacher, and one building principal agreed to participate. Future research could seek more voices of classroom teachers and building principals regarding the consequences of implementing maker programs, as they may interact with the maker program more consistently than the district level administrators in this study. Additionally, further research could explore the perceptions of teachers in terms of how they see maker programs supporting their curriculum specifically. Additionally, this study did not include the perspectives of students. Further research could
explore students’ perceptions of how maker programs are contributing to their educational and emotional experience.

Third, due to the professional background of the researcher, researcher bias is a threat. A positionality statement is provided in Appendix F which identifies how the researcher’s experience, values and expectations may have influenced the conduct and conclusions of the research. The use of a second PhD candidate to co-code qualitative data helped to identify and address potential researcher bias. Additionally, the researcher worked with the other PhD candidate and the dissertation committee who provided external audits to offer suggestions for improvement, check for alignment in the analysis, and provide thoughts on conflicting analysis and conclusions throughout the study. Future research could be conducted by this researcher in geographic areas where they are not well known. Additionally, future research could be conducted by individuals that do not have experience in this field.

Fourth, this study is focused on New York State, therefore generalizability and transferability (Trochim & Donnelly, 2008, p. 149) may be a concern. Transferability and generalizability are strengthened by the number and diversity of participants in the survey, and by the fact that New York State is one of the most diverse states regarding types of schools, communities, and residents. The use of maximum variability sampling for the interviews was an additional attempt to address sampling bias by identifying cases that are different in terms of location, adopter status, and grade level. The researcher was careful not to make generalizations to a larger population from any single participant, and noted when a result could be attributed to only one participant. At the same time, the results of this study may inform further research which explores maker programs in school libraries outside of New York State.
Practical Implications

There are several practical implications from this study, most prominent is that it sheds light on the process of implementing a successful maker program in a school library. The results indicate that a successful maker program needs appropriate staffing including a school librarian with the appropriate dispositions and training, adequate support from administration in terms of funding, space, time, and willingness to provide training, and adequate buy in from teachers and students. Additionally, for school libraries that do not currently have a maker program, the results indicate that the best approach is to start small, with easily obtained materials and projects. This will allow the maker program to grow organically to meet the needs of the school and students without an overwhelming initial investment. Further, visiting a variety of established maker programs provides ideas and insights into the multitude of ways such programs can be configured. For school libraries with current programs, the results indicate that to keep the program thriving, materials and projects should be updated on a regular basis, and librarians should continue to seek new ideas and experiences from others who are implementing maker programs. At the same time, participants indicate that soliciting input from the students and teachers about materials and projects available ensures they are relevant and appropriate for the needs of the social system.

This study calls attention to the need for school library preparation programs to grow school librarians with the dispositions and skills necessary to successfully operate maker programs. Schools that want to have innovative, lively school library programs need candidates who are not afraid to take risks, embrace failure as a learning opportunity, and have child-centered teaching philosophies. When candidates have the necessary dispositions, but not the necessary skills, school administrators need to invest in training. This training needs to go
beyond one shot workshops and needs to cover both how-to and principles knowledge. Although hands on training opportunities that allow practitioners to use new innovations can in part show them the potential, the training needs to be followed by school librarians actually implementing new practices in their schools to see the results for themselves. This study also calls attention to the need to train not only those who are maintaining the maker program, but also to provide training to others in the social system to ensure they understand and use them. At the same time, this research indicates that there are not yet sufficient materials available on implementing maker programs—therefore additional resources need to be created.

The results also indicate that implementing a maker program may address broader educational and societal concerns. Addressing the social emotional skills of students has become increasingly important, particularly in light of the COVID-19 pandemic, which exacerbated an already existing mental health crisis, particularly among children and teens. Additionally, “[m]ental health problems are known to have a disproportionately negative impact on the lives of children and their families who are already disadvantaged” (Cowie & Myers, 2021, p. 70). The results of this study indicate that implementing maker programs in school libraries may be one way to begin to address the social emotional needs of students. They may allow students to view the school library as a safe space (Merga, 2020). They may also be one way to build resilience in students, and support those most at-risk of dropping out of school (Jones, 2009). Further, they may be a way to mitigate the effects of technology usage as they may improve communication skills in a face to face environment (Uhls et al., 2014), and reduce depression (Shensa et al., 2017) and social isolation (Primack et al., 2017).

Participation in a maker program can increase self-esteem and confidence by increasing self-efficacy, it can introduce students to new hobbies, interests, and talents that may lead to a
renewed interest in learning. Maker programs promote collaboration and communication between students, their peers, and educators – allowing students to build relationships and feel a sense of belonging both in the library and in school. Maker programs allow students to build responsible decision making skills by problem solving in an environment where there is less risk, and where failure is seen as a learning opportunity. Maker programs may also allow students to recognize and solve problems in the community, both locally and globally, by building skills identified as key (Olszewski-Kubilius et al., 2016). The social emotional skills students build from participating in a maker program may carry over into other activities, and their regular classwork as their perception of learning and school change, thereby increasing academic achievement.

This research also has practical implications for innovative practices in school libraries in general. It seems school librarians in this study adopted maker programs based on the positive experiences of their colleagues. To encourage innovative practices beyond maker programs, practitioners should continue to share their practices and experiences at conferences and workshops, in professional publications, and in their social media channels. Additionally, administrators should encourage school librarians to seek new practices, as well as provide support in the form of time and funding for librarians to keep current in the field.

Conclusion

Although research on maker programs is growing, there is still much to be learned, particularly regarding school libraries. As schools and school libraries continue to invest in maker programs, it is important to understand the effects they have. This study was a first step in understanding the drivers and consequences of maker programs in school libraries which uncovered several important findings and areas for future research. The findings in this study
highlight the potential for maker programs to have far reaching effects, both positive and negative, that impact students, school librarians, school libraries, schools, and society in general. This study contributes to the fields of school library, education, and makerspace research, however there are also important practical implications. This study suggests that there may be critical success factors for maker programs in school libraries, as well as innovation adoption in school libraries and schools in general.
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nontechnical guide for the social sciences.


Appendices
Appendix A

Recruitment Strategies for Survey

Two recruitment strategies were used – direct emailing, and dissemination by School Library Systems directors. In all recruitment efforts a document was included that outlined the study, how the information would be used, the expected time commitment, the anticipated benefits for participating (Goldstein, 2002, p. 671), as well as indication of IRB approval or exemption and contact information. The survey was open between April 7 and June 1, 2020.

**Strategy 1**

An email with an individual link connected to the school BEDS code was sent to all school librarians with identifiable email addresses. After two weeks, if the survey had not been answered, a reminder email was sent with the same information, and a request to participate. Email addresses were obtained by reviewing New York State School Library Systems member directories posted publicly on the internet, and through school district and building websites, which also post them publicly on the internet.

Due to email filtering programs in school districts – which sometimes caused individual invitations to be rejected or returned to sender – as well as changes in library staffing – which resulted in “addressee unknown” errors, strategy 2 was also used.

**Strategy 2**

At the same time the reminder email was sent for strategy 1, state-wide School Library Systems directors were asked to distribute a BOCES/City System specific link to the questionnaire. After 1 week, the School Library Systems directors were asked to send a reminder to participate. Contact information for School Library Systems directors was obtained from the
School Library Systems Association website, and individual School Library Systems webpages as appropriate. All contact information is publicly available.
Appendix B

Survey Informed Consent

Purpose of the Study

This survey is part of an ongoing study funded by the Institute of Museum and Library Services (IMLS RE-96-18-0032-18): Seeking Stronger Evidence of School Library Effects on Student Outcomes conducted by Dr. Joette Stefl-Mabry and Dr. Michael S. Radlick, researchers from the University at Albany. The purpose of this survey is to identify the unique instructional roles, professional responsibilities, and challenges of certified school librarians in public elementary, middle, and high schools throughout New York State.

Outside the school library community many educators are often unaware of the valuable contributions school librarians make within their buildings and school communities. We value the varied and critical roles school librarians perform within a school (or schools). The purpose of this survey is to help document the work you do on a day-to-day basis as a certified school librarian. As a public school librarian your responses are needed to help provide a comprehensive view of school librarians from all grade levels and across all geographic areas throughout New York State.

The Importance the School Library Data Collected in this Survey

Please note that in 2018 the New York State Education Department (NYSED) removed all but a few basic school library questions from its annual BEDS survey. There is no longer be a statewide source of detailed information about school libraries except for this survey. This survey includes many of the school library questions asked on the original BEDS survey. This will help to preserve an important historical record of New York State school library data.
As a public school librarian your responses are needed to help provide a comprehensive view of school librarians from all grade levels and across all geographic areas throughout New York State.

**Time Commitment and Risks**

The survey should take about 25 minutes to complete. There are no foreseen risks associated with your participation. Your participation is voluntary and you may withdraw at any time without penalty.

**Information Collected and Privacy**

The information you provide will be combined with information from other school librarians and reported only in the aggregate. No individual data that links your name, address, or telephone number with an individual response will be included in our reports. All information you provide will be kept strictly confidential. No one other than the researchers involved in the study will have access to this information. Survey data will be stored on a third party server and while the third party has agreed to keep the data confidential, the University at Albany does not control the security of that server.

This research has been reviewed and approved by the IRB. If you have any questions concerning your rights as a research subject or if you wish to report any concerns about the study, you may contact University at Albany Office of Regulatory & Research Compliance at 1-866-857-5459 or hsconcerns@albany.edu.
Appendix C

Recruitment Strategies for Interviews

Interview were conducted with individuals from schools that are directly or indirectly involved in implementation of maker programs in school libraries.

Participants were recruited according to four criteria – geographic diversity (urban, rural, suburban; location throughout the state), grade levels served (elementary, elementary and middle, middle, middle and high, and high school), adopter status (innovator, early adopter, early majority, and non-adopter), and research access.

Potential cases were excluded if the school librarian did not work in the building at the time the makerspace was established, if the school librarian that answered the survey had left the school, or if the school librarian who answered the survey indicated they did not wish to be contacted for follow-up. Further, cases include only libraries outside of New York City.

For each of the cases, the following steps were taken:

1) Identify contact information of school librarian from the survey. An internet search of the school and library website, as well as existing and emerging networks of contacts of the researcher were also reviewed when necessary.

2) The following email was sent to the school librarian:

Dear [INSERT NAME]:

My name is Shannon Mersand. I am a doctoral candidate in Information Science at the University at Albany – State University of New York. I am working under the guidance of Dr. Mila Gasco-Hernandez, Associate Professor, in the Department of Public Administration and Policy at Rockefeller College of
I would like to invite you to participate in a research study, which looks at the spread of makerspaces and other innovations in school libraries, as well as the existing and potential benefits, costs, risks, challenges, and outcomes of innovation. Your participation in this study is completely voluntary. You can choose to be in the study or not, and you can stop participating at any time.

If you agree to participate in this research, I will conduct an interview with you over Zoom at a time and date of your choice during the month of [INSERT MONTH]. The interview will involve a series of open-ended questions about yourself, your career, your school, your school library, and innovation. It should last about one hour. The interviews will be recorded on Zoom and will be used for transcription and clarification purposes only. If you feel uncomfortable or change your mind for any reason during the interview, I can stop the recording at your request.

I expect to conduct only one interview; however, follow-ups may be needed for added clarification. If so, I will contact you by email to request this. I would also like to conduct an interview with your administrator, or another faculty or staff member who is familiar with the work done in the school library, and I am open to your recommendations.

Attached to this email is an official consent document, which I encourage you to read.
If agreeing to participate, please respond to this email with the following information:

• Your Name
• Three dates and times that would work best for a remote interview
• The name and contact information of one additional adult in your school that you believe would be appropriate and willing to speak regarding innovation and makerspaces in school libraries

If you have any questions, I am happy to answer them by email, or schedule a phone call if you would prefer.

Thank you for your consideration.

Shannon Mersand
Doctoral Candidate – Information Science
College of Emergency Preparedness, Homeland Security, and Cybersecurity
University at Albany
Tel: 518-965-8080
Email: smersand@albany.edu

Informed consent documentation was attached to the email.

3) In the event no response was received within one week, a follow-up email was sent. 48 hours before the interview, a remainder email with the details of the interview was also sent.

4) As noted, suggestions for additional adults to interview and their contact information was requested. Once this contact information was obtained, the following email was sent to other educators:
Dear [INSERT NAME]:

My name is Shannon Mersand. I am a doctoral candidate in Information Science at the University at Albany – State University of New York. I am working under the guidance of Dr. Mila Gasco-Hernandez, Associate Professor, in the Department of Public Administration and Policy at Rockefeller College of Public Affairs and Policy, and Research Director for the Center for Technology in Government at the University at Albany.

I would like to invite you to participate in a research study, which looks at the spread of makerspaces and other innovations in school libraries, as well as the existing and potential benefits, costs, risks, challenges, and outcomes of innovation. Your school librarian [INSERT NAME] has identified you as someone in your school who is well positioned to add insight into this research. You can choose to be in the study or not, and you can stop participating at any time.

If you agree to participate in this research, I will conduct an interview with you over Zoom at a time and date of your choice during the month of [INSERT MONTH]. The interview will involve a series of open-ended questions about yourself, your career, your school, your school library, and innovation. It should last about one hour. The interviews will be recorded on Zoom and will be used for transcription and clarification purposes only. If you feel uncomfortable or change your mind for any reason during the interview, I can stop the recording at your request.

I expect to conduct only one interview; however, follow-ups may be needed for added clarification. If so, I will contact you by email to request this.
Attached to this email is an official consent document, which I encourage you to read.

If agreeing to participate, please respond to this email with the following information:

- Your Name
- Three dates and times that would work best for a remote interview

If you have any questions, I am happy to answer them by email, or schedule a phone call if you would prefer.

Thank you for your consideration.

Shannon Mersand
Doctoral Candidate – Information Science
College of Emergency Preparedness, Homeland Security, and Cybersecurity
University at Albany
Tel: 518-965-8080
Email: smersand@albany.edu

5) In the event no response was received within one week, a follow-up email was sent. 48 hours before the interview, a remainder email with the details of the interview was also sent.
Appendix D

Interview Informed Consent

Study Title: Diffusion of Makerspaces in School Libraries

Principal Investigator: Shannon Mersand, Doctoral Candidate, Information Science

Faculty Advisor: Dr. Mila Gasco, Associate Professor, Department of Public Administration and Policy at Rockefeller College of Public Affairs and Policy, and Research Director for the Center for Technology in Government

IRB Study Number: 22X033

Purpose: You are being asked to participate in a research study about makerspaces and other innovations in school libraries. The purpose of the study is to identify the existing and potential benefits, costs, risks, challenges, and outcomes of innovation in school libraries. Three research questions guide this study: 1) what is the state of making and makerspaces in school libraries?, 2) what are the drivers of adoption of makerspaces in school libraries?, 3) what are the existing and potential benefits, costs, risks, challenges, and consequences of makerspaces in school libraries?

What is expected of you: You will be asked to participate in a recorded interview to answer a series of open-ended questions about yourself, your career, your school, and your school library. The interview should take approximately one hour. The interview will take place on Zoom at a date and time that is convenient to you during the month of [INSERT MONTH]. It is possible follow-up may be needed for added clarification. If so, I will contact you by email to request this.

Rights: Participation in this study is voluntary. If you prefer not to participate or if you choose to withdraw from the study at any time, you may do so without penalty. The information you
provide will be used for research purposes only. This interview will be recorded unless you object to being recorded.

**Confidentiality:** To protect your privacy and that of your colleagues, all transcriptions of recordings will be done within the research team. Transcripts, recordings, and analysis will be kept on a secure server protected by a firewall and passwords, and will be available only to the research team.

Proceedings from this study will focus on general findings. A pseudonym will be used to protect your identity, and the identity of your school, and school district. If concealing identity is not possible due to the small sample size or the uniqueness of the subject under discussion, prior permission will be requested.

**Benefits and risks:** This study will benefit school libraries, schools, and the research community in supporting efforts to adopt innovations in schools. There is minimal risk to individuals and schools participating in this study, and is explained with in the section on confidentiality.

**Questions:** If you have any questions about this study, please contact the Principal Investigator: Shannon Mersand, Doctoral Student, 518-965-8080, smersand@albany.edu

Supporting Faculty Member: Dr. Mila Gasco, Associate Professor, Department of Public Affairs and Policy, (518) 442-3892, mgasco@albany.edu

If you have any questions concerning your rights as a research participant or if you wish to raise any concerns about the study, you may contact the University at Albany Office for Regulatory and Research Compliance at 1-866-857-5459 or RCO@albany.edu.

**Consent**

I have read this form and the research study has been explained to me. I have been given the opportunity to ask questions and my questions have been answered. If I have additional
questions, I have been told whom to contact. I agree to participate in the research study described above and have received a copy of this consent form.

If agreeing to participate, please respond to my email with the following information:

- Your Name
- Three dates and times that would work best for a remote interview
- The name of one additional adult in your school that you believe would be appropriate and willing to speak to regarding innovation and makerspaces in school libraries

Your verbal consent will also be collected during the interview.

Please keep a copy of this information for your records. Research at the University Albany involving human participants is carried out under the oversight of the Institutional Review Board (IRB). This project has been reviewed by the University at Albany Institutional Review Board and was found to be exempt.
Appendix E

Interview Protocol

Introduction

Good ____. My name is Shannon Mersand.

I would like to thank you again for taking the time to participate in this interview. Your experiences are invaluable to my research project.

The purpose of this study is to understand your experience with, and opinions about innovations in school libraries, particularly makerspaces.

A consent form was emailed to you when I invited you to participate. The purpose of the consent form is to inform you of your rights as a participant in research.

Before we get started, I want to review three important things with you:

- This interview is being recorded. If at any time you wish for me to stop recording, please tell me.
- I want to assure you that all information you share will remain confidential, and nothing you say will be attributed to you without your permission.
- If at any time you do not wish to answer any question for any reason, you may choose not to answer.

Consent

☐ Do you have any questions regarding the consent form? [Answer questions as appropriate.]

☐ Do you consent to participate in this research project?

☐ Do I have your permission to record this interview?

Intro and Demographics
First, I would like to get to know a little bit about your professional background.

**ID_1_A Can you give me a brief description of your job [title] and major [responsibilities/activities]?**

Prompts

- Professional background
- Current position
- Major responsibilities
- Degrees/certifications
- Length of time in current positions/education

**Makerspace**

On the 2018 BEDS form it was indicated that there is a makerspace in your school library. I would like to ask you a more about the makerspace

**Makerspace Decision**

**MD_1_A Can you walk me through the decision to create a makerspace in your school library?**

- Who made the decision to start it?
- Why was it started?
- What was the purpose?
- What were the goals?
- What benefits were expected?
- Did you face any challenges?

**Makerspace Implementation**

**MI_1_A Once it was decided to create a makerspace, what happened?**

- Were there any costs associated with creating or running the makerspace?
  - How are materials obtained?
  - How is funding obtained?
- Can you describe any challenges faced while creating and running the makerspace in the library?
  - Interest
  - Administration
  - Time
  - Space
- Can you describe how challenges were overcome?

**Results of the Makerspace**

**MR_1_A What have been the results of implementing the makerspace?**

- What are the benefits of the makerspace?
  - For the library?
Lessons Learned

One of the purposes of this research project is to identify ways that the work already done can inform others about creating and operating makerspaces. I would like to hear about what others in the school community feel about the makerspace, any lessons you have learned, and any advice you might give to others.

**LL_1_A**

**Can you tell me about these things?**

- What feedback have you heard from teachers, administration, students, and the community related to the makerspace?
- What is one thing you would change about the makerspace if you could?
- What advice would you give to somebody who is considering adding a makerspace?

**Conclusion**

**C_1_A**

- What do you see as the future of the makerspace in the next three to five years?
- Is there anything else you would like to share regarding innovation in the school library in general, or the makerspace specifically?

**End/Thanks**

✓ Can you think of anyone else I should be speaking to for my research?
✓ Thank you so much for taking the time to speak with me today.
✓ Would it be okay for me contact you if I need to follow up or clarify a few things?
Appendix F

Positionality Statement

The researcher positions herself as a pragmatist, someone who sees value in approaching problems and collecting data in multiple ways, including various informants, methods of data collection and methods of data analysis. “This philosophy views knowledge as an instrument or tool for organizing experience and it is deeply concerned with the union of theory and practice” (Schwandt, 2015, p. 247). The researcher is a white, lower middle class 42-year-old female. She is employed as school media specialist at a small, diverse, high needs high school in a suburban school district in New York State where she has created and maintains a makerspace in the school library. She has designed and taught multiple professional development workshops, conferences and graduate level courses on makerspaces in school settings. She collaborates with other school media specialists in planning and sharing best practices for maker style learning.

When the researcher started her first maker program in her previous school, she began seeing changes in her students’ attitudes and confidence levels. Even if students weren’t learning content specific knowledge, they were learning about themselves and the world around them. With the understanding that makerspaces are structured very differently depending on where they are located and who is responsible for running them, this researcher is approaching the phenomena in a way that will allow for the differences in spaces to shed light on the differences in outcomes. The researcher believes that there are a variety of potential effects makerspaces have on their users, and that the structure of a makerspace greatly effects potential and realized outcomes for students.