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Makerspaces and the Iowa Core: Connections in a high school library

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Abstract

Studies within the last five years have examined the subject of makerspaces, but few have explored the specific details of how standards and learning are achieved through use of a makerspace. The purpose of this qualitative study is to deepen understanding of five Iowa Core Standards while participants use a makerspace. Additionally, the study aims to determine the degree to which state learning standards are addressed through the activities students engage in during their use of a makerspace in a school library. A sample population of five participants, three students and two teachers were included in the study. One session of observation in the makerspace occurred during each participant's free period. Following the observation session, a one-on-one interview took place with each student. Additionally, a one-on-one interview occurred with two teachers. Upon completion of the study, the researcher found that through their use of the school library's makerspace, students are meeting the five selected Iowa Core Standards: Standard 21.9-12.TL.1, Standard 21.9-12.TL.2, 21.9-12.TL.3, 21.9-12.TL.6, and Standard 21.9–12.ES.4.

MAKERSPACES AND THE IOWA CORE:

CONNECTIONS IN A HIGH SCHOOL LIBRARY

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ABSTRACT

Studies within the last five years have examined the subject of makerspaces, but few have explored the specific details of how standards and learning are achieved through use of a makerspace. The purpose of this qualitative study is to deepen understanding of five Iowa Core Standards while participants use a makerspace. Additionally, the study aims to determine the degree to which state learning standards are addressed through the activities students engage in during their use of a makerspace in a school library. A sample population of five participants, three students and two teachers were included in the study. One session of observation in the makerspace occurred during each participant's free period. Following the observation session, a one-on-one interview took place with each student. Additionally, a one-on-one interview occurred with two teachers. Upon completion of the study, the researcher found that through their use of the school library's makerspace, students are meeting the five selected Iowa Core Standards: Standard 21.9-12.TL.1, Standard 21.9-12.TL.2, 21.9-12.TL.3, 21.9-12.TL.6, and Standard 21.9–12.ES.4.

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CHAPTER 1

INTRODUCTION

"Creativity: The ability to make new things or think of new ideas." -Merriam Webster

Walk into any school library and one may see students engaged with activities like building robots or making a 3D object. Library spaces of today continue to evolve. It is increasingly common in school libraries to see students going beyond their reading by making and creating. In order to let students be creative and innovative, many school libraries have started makerspaces, places where students can gather to create, invent, tinker, explore and discover using a variety of tools and materials. As school libraries change, one may wonder if students' creativity will be carried to new heights due to makerspaces. Students who use hands on materials and build with objects may want to remain in libraries longer in order to engage in their creative process. They may choose to pursue lines of inquiry that help them solve problems and that provide inspiration for future projects. Makerspaces are created with the assumption that they help address cross-curricular standards while providing experiential project-based activities that reinforce learning as a creative process.

Justification

Libraries are evolving into a space that is more than a place for books and research. Makerspaces are a revived trend appearing in many public and school libraries. Enis (2015) theorized about the important democratic role libraries have played in providing knowledge to people through books, through computer access, and through emerging makerspaces:

> Libraries have long been a place that democratized knowledge and content; for a really long time that meant the book, and then it meant

> access to the Internet through computer labs. This is the next step in that evolution, as we move from a society that emphasizes consumption of knowledge to the co-creation and production of knowledge. (p. 24)

As libraries continue to evolve to meet the needs of each patron, many school and public libraries are embracing this trend of making. The production of knowledge is not something new, but providing patrons with materials and tools to do so has made makerspaces a 'must-have' aspect of the library.

Makerspaces were introduced in school libraries during the late 1990s, but their popularity and a maker movement has grown in the last few years. Educause Learning Initiative (2013) defines a makerspace as "a physical location where people gather to share resources and knowledge, work on projects, network, and build" (para. 2). Another definition from The American Library Association (2014) defines it as "a place in the community where individuals can gather, use shared equipment, and learn" (para. 1). School libraries are now seen as providing an active and hands-on experience in addition to a quiet place to study. Elementary school principal, Steele (2015) knew his school library was active with students checking out thousands of books each school year. However, he still wanted more for his students. Steele states:

> It was painful to walk by the library each day and see shelves of books quietly sitting there with little actual learning taking place around them. Something needed to change, and for us, that was the creation of our learning commons/makerspace. (p. 4)

Like Steele, various public and school librarians are now implementing makerspaces or are ready to place one in the library. If a change is needed in the library, librarians are considering this a viable option for implementing it.

Many public and school librarians are taking note of students' needs and bringing in a makerspace in order to provide students with an opportunity to be creative. Makerspaces represent the epitome of creativity. Although many librarians are interested in determining the best supplies, it is vitally important to also determine how the activities may best support national, state, and local curricular standards.

These hands-on areas could include supplies for crafts such as cutting tools, textiles, paper, adhesives, binding, and sewing materials (Sullivan, 2015). Additionally activities and supplies in a developed makerspace may include, but are not limited to, learning about legos, makey makeys, makedos, spheros, computer coding and programing, woodwork, painting, inventing, and graphic design.

Teacher librarians also realize the valuable connection makerspaces have with standards such as the (AASL) the Iowa Core, and the connection to the continued support of the school's mission, vision, and curriculum. For example, AASL (2007) Standard 4.1.2 describes a skill students should gain in order to pursue personal growth. It states, "use creative and artistic formats to express personal learning" (p. 6). The Iowa Core Standards Literacy Standards (Iowa Department of Education, 2011) 21.K-2.TL.1 states the importance of students using technology for creativity: "Use technology to create projects, identifying patterns, and make predictions." Smay and Walker (2015) studied how makerspaces align with national, state, and school standards. For example, makerspaces support school curriculum because it is a resource that "includes co-curricular integration to plan, coordinate, and integrate a design-based approach to help cover the curriculum" (p. 40). For school libraries, makerspaces can provide students with opportunities in science, technology, art, engineering, and mathematics (STEAM).

Due to the unlimited possibilities one could provide in a makerspace, teacher librarians are exploring options that relate to and support the school, students, curriculum, and other state and national standards. The national, state, and school standards all relay the message that students need to be creative. This trait can be achieved through various ways. One way to promote creativity for students includes the use of a makerspace. The President of Generation YES and author of *Invent to Learn: Making Tinkering, and Engineering in the Classroom* Martinez and Stager (2013) strongly believe in programs such as the maker movement because they empower students to be creative: "Creation is the heart of creativity and is only meaningful when grounded in action--it's not a feeling, a mindset, or an outcome. But it can be developed...students learn creativity by being creative (pp. 80-81).

However, there is also a need to understand a framework for makerspaces that is more than citing the popularity of them or connecting them to potential for creativity. Determinations of efficacy are needed in order to make informed decisions as to the applicability and relevance of the concept for one's library. Some also argue that the makerspace movement isn't all about the equipment. Rather, Enis (2015) purports it is about the shared community and creativity: "Makerspaces have served to clarify that the movement is about an ethos, not equipment" (p. 25). Each Maker program offers its community a place to gather, share expertise, and work creatively and collaboratively" (p. 25). Smay and Walker (2015) agree with this statement and add that when given the opportunity to work together with teachers and students to understand what they want to learn, this maker movement will no doubt "empower students" and "turn them into

confident leaders and problem solvers who can shape their own learning and their own lives" (p. 41).

Significance

As makerspaces grow in popularity, teacher librarians need to know what they are and how they may best be used to promote student learning. Knowing the definition of a makerspace, and how it relates to curriculum standards at the national, state, and school levels will help teacher librarians create a makerspace as part of their schools' STEM initiatives.

Problem Statement

Makerspaces have recently gained popularity within public and school libraries. Teacher librarians may want to create their own makerspaces but may not know if the activities and items used for the makerspace with various national and state learning standards.

Purpose

The purpose of this study is to observe whether Iowa Core Standards are met when students use a makerspace.

Research Questions

1. Are the activities in a makerspace meeting Iowa Core Standards?

2. How do teacher librarians know students are learning by using a makerspace?

Assumptions

An assumption of this research paper is that some teacher librarians do not know how the Iowa Core Standards and makerspaces are connected regarding learning.

Another assumption of this research paper is that some teacher librarians may hesitate to incorporate a makerspace into their school libraries.

CHAPTER 2

LITERATURE REVIEW

The purpose of this study is to observe if learning occurs when students are engaged with a makerspace. Research previously conducted concerning makerspaces fell into the following categories: the evolving role of libraries, importance of makerspaces, and connecting makerspaces with creativity and standards.

The Evolving Role of Libraries

School libraries across the world are evolving into a more hands-on approach of learning through making. Sheridan et al. (2015) conducted a comparative case study of how makerspaces serve as learning environments. Additionally, these authors describe the ways students were able to help with problems while revising, sharing, and evaluating the works they made. The study explored three makerspace sites, and people of all ages-four-years-old and older - participated in this study. The three makerspaces in this study included an adult makerspace called Sector67, a second makerspace called Mt. Elliott Makerspace, and a third site called Makeshop. Over a period of one year, the researchers conducted 150 hours of field observations along with interviews and detailed analyses of online postings and community discussions. Their main finding was that learning is different for everyone. Sheridan et al. (2015) discovered that it was similar to a learning community where at times, the teacher becomes the student and vice versa. Results also showed that the majority of people who participated in a makerspace had freedom if they wanted it, or guided instruction by an expert, but in either case the experience was more about the process than the end result. As Sheridan et al. analyzed these three makerspaces, they understood how each supported making through different

arrangements such as one-on-one making, facilitated one-on-one or small group projects, online classes, and structured classes. The researcher also noticed the differences among the three makerspaces. The major difference between the experiences engendered by the makerspace was the duration of each project and how well the maker used the various materials and space. Although every makerspace and its participants was diverse, researchers were able to note one unifying theme: each maker used a variety of tools, materials, and thought processes to complete a project. Overall, no two projects started and ended in the same way.

Whereas Sheridan et al. (2014) analyzed makerspaces outside of education, Moorefield-Lang (2015) researched makerspaces in four K-12 school libraries, four in public library settings, and four in university libraries. This study resulted in many perspectives on makerspaces and how they are used in libraries. Participants included 12 teacher librarians and each individual librarian was interviewed on an individual basis. Their answers were analyzed using Nvivo 10 qualitative data analysis software. Though this study had a wide range of ages including kindergarten through twelfth grade and higher education, there was one very distinct theme that emerged from the interviews. This theme included librarian training on the makerspaces. Moorefield-Lang discovered each public or private employee of the library proceeded with a makerspace through trial and error. Most school or public librarians were obtaining information from other makerspaces and through online sources. Even though most school and public makerspaces began with little guidance, these librarians gave patrons what training skills they had in order for the makerspace to get started. Overall, continued training is a concern for librarians implementing makerspaces in their libraries.

Similar to Sheridan et. (2014) and Moorefield-Lang (2015), Koh and Abbas (2015) also conducted research to gain understanding in the competencies for a successful makerspace by interviewing nine professionals. These nine professionals included five museum professionals, three public librarians, and one professional worker in a science center. All professionals interviewed were directors of the makerspaces in their places of employment. Work experience of the nine interviewees, five female and four male, ranged from one year to 20 years. Researchers analyzed the recorded interviews using Dedoose software. Through analysis of the interviews, five key competencies were discovered. The five key abilities needed for a successful makerspace are the ability to learn, to adapt to changing situations, to collaborate, to advocate for the makerspace, and to serve diverse people. Additional findings showed a need to examine soon-to-be library studies graduates' education about makerspaces and how it transfers to future practice of the profession.

The above group of studies about the evolving role of libraries showed a connection between makerspaces outside of the school setting (Sheridan et al. 2014; Koh and Abbas, 2015) and school library makerspaces (Moorefield-Lang, 2015). These studies show the value of makerspaces within the changing roles of libraries, whereas the current study will examine whether creativity and learning are demonstrated through students' use of a makerspace.

Importance of Makerspaces

As libraries continue to evolve, the research provides insights into the needs met by and the challenges presented by the introduction of makerspaces. Moorefield-Lang (2014) conducted a case study to describe the success and challenges of having a 3D

printer in a makerspace. Six total libraries were involved in this study. These included two school libraries, two public libraries, and two academic libraries. Six librarians from each site were interviewed through online communication tools such as Skype and Google Hangout. Each interview was transcribed verbatim. The interview questions ranged from items asking how many 3D printers the library had, to questions addressing successes and challenges the librarians faced in their library settings. Moorefield-Lang (2014) found commonalities between each makerspace. One commonality shared by the various librarians was the need to have rules and agreements among the patrons and students regarding items such as the 3D printer. The 3D printer was an expensive purchase for each librarian and assistance and training in its use was needed. Another commonality shared between librarians was the many opportunities the makerspace presented for the learner to become the teacher. Participants agreed on the importance to makerspaces of the purchase of new items such as 3D printers to enhance students' knowledge and creativity.

Santo et al. (2010) conducted a case study of a community organization called the Brooklyn Neighborhood Center exploring the learning, pedagogy, and innovation transpiring within makerspaces over an 18-month period. Researchers collected approximately 50 hours of interview data through 13 different meetings. Most of the interviews were conducted by the director of the Brooklyn Neighborhood Center. Other data sources included meeting notes, public documents, blog posts, photos, and other videos from the center. Much like Moorefield-Lang (2014), Santo et al. (2010) found that the pros of having a makerspace outweighed the cons. Among the copious amounts of

positive outcomes, the overall study concluded it has endless possibilities of learning within an authentic space.

Kurti, Kurti, and Fleming's (2014) exploration of the importance of makerspaces focused on a public high school library. Through this small case study, the researchers were able to gain insight into the start that took place in the library after a new teacher librarian was hired to transform the space into a more active place. The new librarian was asked by the then school principal and well-known educational leadership figure, Eric Sheninger to transform the library into a place that students would want to make, create, and learn. Over the course of two months, the researchers were able to observe and interview the teacher librarian about the process that took place in the library. The findings identified a space unlike other classrooms. Students were engaged with activities such as building Legos, utilizing a Makey Makey station, and manipulating old computers with tools to take them apart and build something new.

Overall, the studies described above about the importance of makerspaces showed the success of creating a space unlike other classrooms (Moorefield-Lang, 2014; Santo et al., 2010), yet also mentioned how makerspaces were fairly new to public and school settings (Kurti et al., 2014). These studies show the importance of makerspaces, whereas the current study will interrogate the concept in action to analyze if learning happens while one creates in a makerspace.

Connecting Makerspaces and Learning

Litts' (2015) studied three youth makerspaces, but most importantly for the current study, how learning is demonstrated within these spaces. Litts had three goals in mind during her research. These three goals were 1) to analyze the strengths and weaknesses of three

makerspaces including a makerspace in a museum, one in an after school program, and one in a library; 2) to understand how young makers approach a task and finish a project; and 3) to understand the beginning and end assessment of makerspace activities. The three makerspaces Litts observed were those at the Children's Museum of Pittsburgh, Assemble, and the Millvale Community Library. Litts conducted a combined total of 50 observation hours, interviewed seven people involved with the three makerspaces. Litts noticed commonalities between each site in relation to learning while also being creative. First, at all the sites, the teachers or facilitators wanted the youth or students to become the teacher to others. Second, every person took part in the collaboration of the space at every site. The major differences between these makerspaces relate to time spent on the project and the structure of the actual space. For example, at the Children's Museum of Pittsburgh offers one day activities and longer activities that could take much longer than one day. Most of the time, participants at this makerspace are on their own. At Assemble, more structured classes are offered with a ratio ten students to one instructor. Assemble offered a schedule of classes so participants could take classes to learn and make certain items. Overall, participants could demonstrate that creativity and learning were present during each individual's makerspace time due to a learning-assessment rubric fitting each individuals' needs and goals.

While Litts' research determined if creativity and learning were present during an individual's time while in a makerspace as determined by the completion of a learning-assessment rubric, Small (2014) studied 90 fourth through eighth grade students utilizing phone interviews and online surveys. Lastly, these researchers collected data from these students to track how closely related creativity, makerspaces, and effective teacher

librarians can help. Small (2014) explored the topic of innovation through her analysis of phone interviews and online surveys; she also studied the importance of a teacher librarian to make the connections within one's school. According to these researchers' findings, school libraries play a valuable role in every school. Small (2014) states:

> School librarians must help all students develop strong inquiry skills. School librarians must also help change these young innovators' outdated perceptions of libraries as book repositories so learners can, instead, see libraries as innovation spaces where ideas are valued and creativity flourishes. In the process, young innovators' perceptions of librarians' roles would change from gatekeepers to 'innovation mentors' (p. 18).

School libraries transform students' creativity and much more. While school and public libraries have been the main focus of this literature review, online makerspaces seems to be the newest form of collaborating, creating, and making with anyone in the world. Researcher, Beth Godfrey's (2015) dissertation focused on three separate online makerspaces, and more specifically, on how many of these makers were female. One online makerspace was called Instructables. Instructables is an online website where anyone's do-it-yourself projects are videoed or photographed and users can comment on each project. The ages of their participants vary. The next online community makerspace and magazine is called Make. Godfrey noticed about 80% of writers for this online space were male, and 20% were female. The last online makerspace studied by Godfrey was Hackaday. This small online community, consisted of 15 male and five female employees.

Godfrey used a mixed method of qualitative and quantitative data to compare and contrast each site. First, the researcher analyzed each online site in terms of size, capabilities, and overall operation. Next, she gathered information in a database and

recorded what was made on the websites and by whom. Lastly, she administered surveys that included a variety of questions addressing a range of topics from projects to practices to demographics. From the many questions asked by this researcher, her main findings throughout all three makerspaces was clear. Women and men both made items, but the category of the project was labeled differently by them. For example, through the Instructable online makerspace website, 85% of those identifying as male and 15% of those identifying themselves as female made items related to technology. In terms of each group making an item related to living, 85% of females and 15% of males used this label for their projects, e.g. related to topics like parenting or cooking.

Overall, these three studies relate in terms of impact. Whether the makerspace was used to lead innovation in a fourth grade school library (Litts, 2015) or through online forums like the Instructables (Small, 2014), each makerspace serves creative purposes for all participants (Godfrey, 2015). These three studies are important to this researcher because different ages and grade levels will be considered for this action-research study.

Summary

Numerous studies have investigated how teachers and public librarians connect learning and creativity for students of all ages and backgrounds (Sheridan et al., 2014; Moorefield-Lang, 2015; Koh & Abbas, 2015). Most of these studies have utilized qualitative and quantitative research methodologies with small and large size makerspace communities (Moorefield-Lang, 2014; Santo et al., 2010; Kurti et al., 2014). Since the current iteration of makerspaces is fairly new, there is still more to study about how it relates to learning (Litts, 2015; Small, 2014; Godfrey, 2015). To extend the

aforementioned studies, this researcher identifies the need to examine the practices of secondary education students within a makerspace of a school library.

CHAPTER 3

METHODOLOGY

While many researchers have studied the different kinds of makerspaces in public and school libraries, few studies have focused on the connection between the makerspaces and achievement of learning goals. In order to do so, this study, explored one high school makerspace, in a school library serving grades 9-12 in an effort to answer the following questions:

1. Are the activities in a makerspace meeting Iowa Core Standards?

2. How do teacher librarians know students are learning by using a makerspace?

Research Design

The research conducted contains qualitative data obtained through direct observation and one-on-one interviews with participants. After attending the Iowa Technology Education Conference in October 2015 where many presentations and topics dealt with the concept of makerspaces in a school setting, I was motivated to implement the ideas in the school library in which I serve as teacher librarian.

The makerspace featured in this study was a new addition to the school library. It was created for student use in January 2016 and this study of its use began in February. The first items placed in the makerspace were the cardboard challenge and a greenscreen for the production of movies. The cardboard challenge consisted of participants using cardboard to design anything they desired. The cardboard challenge was to make something different with the cardboard other than its original box shape. In addition to cardboard, other items were provided for participants. These items include scissors, tape, glue, paper clips, stapler, rulers, markers, a small saw, and Make-Dos. Make-Do are

plastic pieces like screws that help fasten cardboard together. Since these pieces are made out of plastic, they can be continuously reused.

In addition to the cardboard challenge, a greenscreen was placed in the makerspace. Out of the three participants, one student picked working with the greenscreen. This greenscreen is not painted on a wall but is a real, green cloth sheet stretching from floor to ceiling placed on the west wall in the makerspace. The library provides access to the greenscreen, one tripod to hold the library's iPad, and the app called Green Screen Do Ink.

Once the makerspace was in place and being utilized, I began to explore its potential to impact student learning. The study described here examines the activities of students using a makerspace and the relationship of those activities to meeting learning objectives as articulated in state standards.

Participants

There were a total of five participants included in this study. Three participants were high school students. Participant A is in 9th grade, Participant B is in 10th grade, and Participant C is in 11th grade. The participants included two male students and one female student. Participants were between 14-17 years of age. These students met the criteria for this study because they were interested in creating items at school and had at least one free period during which they could visit the makerspace. Two of the participants only had a free period three times a week, and one of the participants had a free period every day.

Two teachers were also interviewed about their use of the makerspace in the library. The two teachers were selected because they created group projects specifically to use the makerspace.

Procedures

The task of qualitative data collection occurred through direct observation of participants' use of the makerspace. According to Wildemuth (2009), "The purpose of direct observation is to find out what people do; that is, this method of data collection is focused on the behaviors of participants in a particular setting (p. 189). Wildemuth (2009) recognizes the strengths of this method. I also created an Observation Rubric with five 21st Century skills used from the Iowa Core. These five standards were used as the basis for documenting points of comparison during the observation of participants using the makerspace.

The five standards chosen for the Observation Rubric (see Appendix A) included five standards from the Iowa Core section titled "21st Century Skills." One standard used was Standard 21.9-12.TL.1. It states, "Demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology" (Iowa Department of Education, 2016). The second standard used was Standard 21.9–12.TL.2. It states, "Uses digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others" (Iowa Department of Education). The third standard used was Standard 21.9–12.TL.3. It states, "Apply digital tools to gather, evaluate, and use information" (Iowa Department of Education). The fourth standard used was Standard: 21.9–12.TL.6. It states, "Demonstrate a sound understanding of technology concepts,

systems and operations" (Iowa Department of Education). The fifth standard used was Standard 21.9–12.ES.4 "Demonstrate initiative and self–direction through high achievement and lifelong learning while exploring the ways individual talents and skills can be used for productive outcomes in personal and personal life" (Iowa Department of Education).

There have been various studies on makerspaces, but none that specifically connected state standards to learning. To guide observation of the potential learning transpiring through use of the makerspace, I examined the Iowa Core Standards for the implied goals contained therein. The learning standards deemed relevant to this investigation were those involving design, construction, innovation, collaboration, use of digital tools, problem solving, and understanding of technology systems and operations. As the school library continues to evolve, a place for creation, learning, and making have blended into a unique environment known as a makerspace.

The technology literacy standards used in the Iowa Core are detailed items beginning with kindergarten and ending with twelfth grade students. The Iowa Core connects every student in this state with technology literacy standards. I developed this study to emphasize these standards and explore if they describe the same type of learning that occurs within a makerspace.

Following the initial direct observation and a semi-structured interview, one more direct observation was conducted by the researcher. According to Wildemuth (2009), this research can capture students using the makerspace because this researcher is "interested in people's information behaviors, [so] direct observation will be a useful research method" (p. 197). With any research method, there are limitations. One limitation of this

study is that observation can happen at random times. Also, if the participants know they are being watched, they may not act naturally. Despite these, the positive aspects of direct observation outweigh the negatives.

Additional data was gathered after the direct observation. The researcher used a qualitative, semi-structured interview research method. According to Wildemuth (2009) qualitative research methods such as a semi-structured interview "are one of the most useful data collection methods for studying a wide range of information behaviors" and aren't as structured as surveys (p. 239). Even though a semi-structured interview is open for more questions, a limitation to this method is that each researcher will "need to plan [the] interview guide carefully and fully pretest it before conducting [the] interviews" (Wildemuth, 2009, p. 240). The interview questions for this study are found in Appendix B. According to Wildemuth (2009), the basics of interviewing are as follows: introduction, warm-up, main body of the interview, cool-off, and closure. The researcher followed this framework. This semi-structured interview focused on gathering data about the process of learning that happens while in a makerspace. The researcher took notes and audio recorded each interview for analysis.

The following information will provide details regarding the procedures used during this research study. Each participant was invited to participate in the study through email. The researcher identified the participants because the researcher knew each one had a free period and had asked questions in regards to the makerspace out of curiosity. Before research started, the research was approved by the University of Northern Iowa's Institutional Review Board. Once approval was granted, parental permission for students to participate was obtained. A total of three students participated, two were male, and one

was female. Two teachers participated, and both were female. Each student was observed using the makerspace during one 43 minute class period. After I observed their use of this space during one single session, I then scheduled a time to conduct one-on-one interviews. Students did not miss any instructional time with teachers by participating in this study.

The researcher developed questions related to each student's experience within the school library makerspace. These interview questions were administered to three students with one-on-one interviews. While the researcher is a teacher librarian, the participants are students who were willing to visit the library on their own time. The teacher librarian observed and interviewed three students, one each from 9th, 10th, and 11th grade and two teachers in one midwest high school. These five participants represented an enrollment population of about 700 students and two teachers in the building. The teachers interviewed have used the makerspace for class projects. These teachers will only be identified by the subjects they teach.

Next, after an initial direct observation and a semi-structured interview, one more direct observation was conducted by the researcher, and more notes were compiled using the Observation Rubric (see Appendix A).

With any direct observation, researchers need to keep in mind "that being watched is often bothersome to people; and that additional ethical issues may arise during the observation" (Wildemuth, 2009, p. 192). Wildemuth recommends "developing a plan for collection of a sample of data that is appropriate for the goals of your study" (p. 190). During the observation, the researcher created and used an Observation Rubric to record data while observing students' use of the makerspace. The researcher used the

Observation Rubric for guidance when the participants used the makerspace. The Observation Rubric was created by the researcher for this study.

Observation Rubric

The Observation Rubric was created and used throughout the observation portion of this research study. Each standard was listed. While the researcher observed each participant, each standard was marked with either ‘never,’ ‘sometimes,’ or ‘always.’ If the participant never demonstrated the standard, ‘never’ was marked on the rubric. If the participant sometimes demonstrated the standard, ‘ sometimes’ was marked on the rubric. If the participant always demonstrated the standard, ‘always’ was marked on the rubric. The researcher also left a column blank so additional notes could be made during the observation period.

CHAPTER 4

FINDINGS

The purpose of this study was to observe whether learning goals articulated by five Iowa Core standards are met when students use a makerspace. Participants were observed in the makerspace during one 43 minute session before each interview and one more time after the interview. While using the makerspace, students were observed and their activities were noted using the Observation Rubric. Five standards were aligned with five Iowa Core Standards in the creation of the Observation Rubric. See Appendix A.

The Iowa Core has five categories for 21st Century skills. These categories are Political Science-Civic Literacy, Employability Skills, Financial Literacy, Health Literacy, and Technology Literacy. Each of these five categories have five to six standards. The researcher chose standards with a broad definition for this study. Four of the standards used for the Observation Rubric were from the Technology Literacy category and one of the standards used for the Observation Rubric was from the Employability Skills category. The choice to focus on five standards was based on the researcher's teaching experience and knowledge of what constitutes a reasonable goal for attainment within a single class period. Given that a class period is 43 minutes in length, this also seemed a sufficient and manageable time to obtain robust data from participant observation.

Data Analysis of Student Participants during Observation

The findings of this study will be helpful to teacher librarians when implementing a makerspace in their schools. It provides teacher librarians needed confirmation that at

least five Iowa Core Standards are addressed and that learning occurs while students use a makerspace.

Participants A and B shared the same free period and chose to begin the cardboard challenge in the makerspace. In this challenge, each participant repurposes cardboard to function as anything else besides a box. Standard 21.9-12.TL.1 states that participants will demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. During observation, Participants A and B accessed what tools were available to them and determined how much cardboard was in the makerspace. The researcher observed Participant A offering ideas while Participant B went immediately to build. Participant A served more as a leader during this observation period and Participant B wanted to touch all the materials. This standard also states that students will use technology. Both participants A and B used Make-Dos to hold the cardboard together. Overall, Standard 21.9-12.TL.1 was met by Participants A and B.

Participant C had a different free period than that of Participants A and B and worked alone in the makerspace. Participant C decided not to begin the cardboard challenge, but was immediately drawn into the idea of using the library's iPad, green screen, and the app, Do Ink, during time in the makerspace. After I explained the basics of greenscreen production, Participant C repeatedly stated he would figure it out. He had never used the app Do Ink before. Prior to this time in the makerspace, Participant C knew how to take photos and pictures on his iPad. Participant C also knew how to make an iMovie. Participant C wanted very little explanation and demonstration from me.

During the observation period, the researcher noticed the use of Standard 21.9-12.TL.1. For example, creative thinking happened because the participant took several

shots of himself using the greenscreen and testing various backgrounds on the app. Participant C also constructed knowledge and developed innovative products because he found a background for a weather forecast. Participant C knew that forecasters use a greenscreen for the news and that he could also make up his own forecast. During observation, this participant experimented with different backgrounds, but was interested in the forecast background and used it for most of the time Participant C spent in the makerspace. The researcher was careful not to interrupt because soon after selecting the background this participant began filming. A formal script was not used while in the makespace but rather Participant C's dialogue was spontaneous and the actual video footage did not last over 30 seconds. The process of using technology as described in this standard was attained through use of the iPad, the Do Ink app, and the greenscreen to make the forecast possible. Overall, all participants were able to achieve standard 21.9-12.TL.1 from the Iowa Core.

The second standard used as a guiding framework for observation in this study was Standard 21.9–12.TL.2. It states that students will use digital media environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Participants A and B were only able to achieve parts of this standard. Of course, Participant A and Participant B worked collaboratively with each other. For example, Participant A wanted to plan more and took a more leadership role while working with Participant B. Participant A used paper and drew out a few ideas while Participant B used the materials before a plan was formed. Participant A and Participant B were opposites in the way each approached the cardboard challenge, but fit nicely with each other because once Participant A decided on what to

build, Participant B was on board. Participant A decided to build a book-drop for the library. Due to new furniture items in the library like the circulation desk, a book-drop was missing. Participant A thought of the idea and assessed how much cardboard was needed. Participant B supported Participant A's decision to make a book-drop. Both participants communicated with each other and worked collaboratively to begin the process of building. Participant B supported what Participant A wanted to build. The one aspect of the standard that was not met was the use of digital media. Participants A and B did not use any computer device while in the makerspace.

Much like Participant A and Participant B, Participant C was able to complete some parts of Standard 21.9-12.TL.2. Participant C supported himself with individual learning because he worked alone within the makerspace's greenscreen. A makerspace can be used alone or with others. During this study, the researcher witnessed both individual time and group time spent in this space. With this in mind, Participant C attained the standard's objectives of individual learning and digital media to communicate because Participant C learned how to use the Do Ink app with the greenscreen effectively. Through observation, the researcher noticed that Participant C was not initially satisfied with the backgrounds. After using a space themed background and next a picture of the world background, Participant C noticed the weather forecast background and decided that was the best option. Participant C used digital media in the makerspace environment to communicate and support individual learning. The only element missing from Participant C meeting Standard 21.9-12.TL.2 was working collaboratively with others. The researcher was able to mark 'sometimes' on the Observation Rubric for this standard.

The third standard addressed through this study was Standard 21.9-12.TL which states students will apply digital tools to gather, evaluate, and use information. Participants A and B were marked on the Observation Rubric for this standard as 'sometimes.' Participants A and B used tools to gather, evaluate, and use information, but not in the digital sense. For example, Participant A took more of a step-by-step design approach for the cardboard challenge. Participant A wanted to sketch, discuss, and use information to build a book-drop that would actually work for the library striving for the project to be personally meaningful and meaningful to others. Participant B initially suggested building an airplane after Participant A discussed a book-drop. The researcher thought this could be a large problem if Participants A and B did not agree on what to build. Participant A persuaded Participant B to build a more practical object. In a collaborative effort, the makerspace forced both participants to discuss what worked the best, to apply what they both wanted, and to effectively use the information they already had to make a worth-while project. Before Participants A and B began any discussion of the item they were to build, they were only asked to build something new out of cardboard. The researcher did not persuade any of the participants to build something the library could use.

For Participant C, this standard (apply digital tools to gather, evaluation, and use information) was marked as 'always' on the Observation Rubric. Participant C used the iPad and the Do Ink app to gather the right background picture for the greenscreen. Through trial and error during this part, Participant C evaluated the various features of the backgrounds using the greenscreen for about a minute to record a less than five second clip, only to play it back and review the appearance of the background. The

researcher was told during the observation session that Participant C would be using this space soon for an English class project on Greek mythology. The researcher did not discuss this with Participant C during the observation session but was informed students would know what to do once the English class was asked to make a greenscreen clip. Overall, Participants A and B only partially met this standard because they did not use any digital tools, but Participant C met the full standard of Standard 21.9-12.TL.

The fourth learning standard referenced for this study was Standard 21.9–12.TL.6 which states that students will demonstrate a sound understanding of technology concepts, systems and operations. Participants A and B were observed and marked as 'sometimes' for this standard. The researcher observer marked 'sometimes' because participants evidenced some understanding of technology concepts, systems, and operations but not a sound understanding as stated in the standard. That being said, due to the fact that observation was limited to a single session of 43 minutes, it is clear that 'always' would be difficult to mark on the Observation Rubric due to time limitations. Both participants understood how the tools, including the MakeDos, worked. Both participants were able to begin the process of cutting and piecing items together, but this project was not completed during the observation session. Participants A and B were able to complete two sides of the book-drop during this time. Before the class period was over, Participant A took on more leadership and discussed with Participant B about what would happen during the next time they were in the makerspace. Both looked eager to make more, but due to time restraints had to stop.

Unlike Participants A and B, Participant C was marked as 'always' for Standard 21.9–12.TL.6. During observation, the researcher marked down that the participant had

learned the basics of the app quickly, understood how to film, and was able to play back and comment on the clip. The researcher has noted that even during the short period of time while using the makerspace, a sound understanding of the technology concepts, systems, and operations were apparent. From this one session using the greenscreen, Participant C will be able to quickly show others how to use the Do Ink app when asked to do so in English class. Participant C learned how to use the digital tools to produce a personalized weather forecast clip and was able to quickly help three other group members make a clip for their Greek mythology unit The fifth standard served as a framework for this study was Standard 21.9–12.ES.4 which states students will demonstrate initiative and self–direction through high achievement and lifelong learning while exploring the ways individual talents and skills can be used for productive outcomes in personal and professional life. Participants A and B were marked as 'always' meeting the standard during the observation session as they demonstrated much self-direction. For example, while Participant B suggested making an airplane, it was clear to Participant A this would not be the best option. The researcher did not make any suggestions as to what they could build, but from the beginning, Participant A wanted it to be something the library needed. Participant B, although not labeled as the leader took initiative by digging right into the cardboard, being autodidactic on the use of the MakeDos, and being generally more hands-on than Participants A and C. Both participants showed high-achievement and lifelong learning through working together, collaborating on a design, and eventually beginning the process of actually building the drop-box. Due to Participant A's talent and skill of being a leader and Participant B's

talent and skill of construction, both of their personalities shined during this observation time.

Participant C was also marked as ‘always’ for this standard on the Observation Rubric. Since this participant worked alone, self-direction and initiative were necessary to begin the project. Students who volunteer to work within a makerspace at the high school level choose to use the space since the makerspace is fairly new for this school, students would need to demonstrate their own drive and self-direction to give up time on homework or studying to be in the space working on their own projects. Participant C wanted to be in the makerspace out of curiosity, and he knew the English classes would use this space soon as well.

Reviewing the Observation data revealed that all participants demonstrated a sound understanding of technology, creative thinking, collaboration with others, and self-direction while using the makerspace. The fact that participants are interested in this space means they likely enjoy creating, using technology, and working with others.

Analysis of Student Interviews

The second research question the researcher aimed to answer was: How do teacher librarians know students are learning by using a makerspace? The makerspace participants were observed during one class period and then interviewed during another class period after using the makerspace. This makerspace study was conducted one month after the makerspace’s debut in the library. The researcher sought students who already had a free period and were interested in the space. Participants could easily identify what one was learning while using the makerspace.

The researcher conducted an interview with each participant allowing them to provide further insight into the makerspace. The first question asked of each participant addressed motivation for using it. Each provided different reasons for using the makerspace. Participant A needed a break from regular classes. Participant B was curious about the new space and wanted to try something new. Participant C wanted to see what others were making while in the space having previously noticed friends using cardboard in it.

After general questions were asked such as how often does the participant use the makerspace, the researcher sought details of what occurred during the time spent in this space and for what purpose. The heart of the matter for this study is to determine if learning is taking place within the makerspace. Participants A, B, and C were asked about their time spent in the space and if they experienced learning while there. All participants agreed that learning did happen either while working on the cardboard challenge or during use of the greenscreen. For example, Participant A described "thinking about the process, designing something, helping others, sketching, and talking to Participant B about it, too. I'm learning what will work best and what won't." Participant B noted that math was used due to having to take measurements of the drop-box and that other skills were engaged also: "I'm exploring what we could do. To make it (cardboard drop-box) you would need to be able to think, cut, put together something that will actually work." Participant C worked in the makerspace on a greenscreen clip, and noted the learning that took place while using it: "I need to know how to work my iPad plus the app. I'll need to know how to edit the stuff I'm filming. You would need to know how to upload it to YouTube, but I haven't gotten that far yet. Yes, I'm learning how to film, use the

greenscreen, and share it with others." Not only did these students learn new things while working in the makerspace, they were aware of their learning and able to reflect on it.

Analysis of Teacher Participants during Interviews

Since the greenscreen is new to the library space, both teachers wanted to try it out for one assignment to see how students would work within the space. The researcher is the teacher librarian for the school and values a makerspace for reasons such as learning, creating, designing, and collaborating. Both teachers interviewed for this study also shared similar reasons for why one would use the makerspace in a classroom setting.

After the observation session and interviews from Participants A, B, and C, the last component of this study was to interview teachers who have used the greenscreen during class. Two English teachers used the greenscreen since it was installed. Both of the English teachers interviewed for this study have used the makerspace for greenscreen purposes only. English Teacher A used the greenscreen with her freshmen students in English I to make a short movie clip summarizing a god or goddess from Greek mythology. For the greenscreen assignment, students were divided into groups of 4-5. Each group was to brainstorm, plot the story line, assign each group member a speaking role, pick a background for the clip, and film it. This was the first time English Teacher A used the greenscreen in her classes.

English/Drama Teacher B used the greenscreen for the first time during her Advanced Placement Literature classes. Each student in English/Drama Teacher B's classroom used the greenscreen to analyze scenes from *Hamlet*. The assignment was to verbally analyze clips of *Hamlet*. More specifically, each small group needed to evaluate the director, actor, or audience and analyze Shakespeare's purpose, the character's

purpose, as well as, themes they had previously learned. Students needed to have the clip on the greenscreen and verbally analyze multiple aspects of the play. After each group completed filming, the clips were viewed in class and a large-group discussion followed.

During the interviews, the researcher asked about each teacher's views on why they chose to use the makerspace during their classes. English Teacher A used the makerspace because "students can live out their learning. They don't just read about what goes on with a character, they become that character. It makes it more real to the readers in my class, and hopefully sparks an interest in further delving into anything they read." This leads the researcher to believe that the makerspace is something they value for their students. English Teacher A wanted to make reading literature more authentic for each student. This specifically ties in with Standard 21.9–12.ES.4 which states: Students will demonstrate initiative and self–direction through high achievement and lifelong learning while exploring the ways individual talents and skills can be used for productive outcomes in future classes.

English/Drama Teacher B also wanted her students to go beyond only answering study guide questions. Her final assessment after the group greenscreen project and discussion required each student to write an essay analyzing the overall characters and themes in the play *Hamlet*. This was Teacher B's first time using the greenscreen with her students, and she felt it was a success. Teacher B stated, "The final written assessments over *Hamlet* showed greater depth of understanding as well as an analysis of smaller details that are easy to gloss over in the text, but do have impact when presented and analyzed visually. Generally, after a green screen experience, critical thinking is much more developed and nuanced."

Summary

The observations and interview responses in this study indicate that Participants A, B, and C learned the skills addressed in several of the Iowa Core Standards through their use of a the makerspace. One major theme that emerged was that the makerspace provides a unique learning space in that students are willingly able to learn without specific, guided instruction. During this study, students were self-guided and did not follow specific instructions. Participants may not have always known the direction a project would go or how it would turn out, but participants were thinking, designing, creating, collaborating, experimenting, building, and using technology within the makerspace. Participants valued working with others to create something new. Students are able to engage in activities in ways that they value while teachers are able to address the required learning standards.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

Researchers such as Sheridan et al. (2015) Moorefield-Lang (2015), and Koh and Abbas (2015) conducted studies that acknowledge how makerspaces serve as learning environments. High school students are highly capable of learning in a makerspace. The purpose of this study is to observe whether Iowa Core Standards are met and learning takes place when students use a makerspace.

Conclusions

The makerspace participants were provided an opportunity to create, learn, and make during their free periods. The projects pursued exposed students to new ideas, design, technology integration, collaboration, and creation. The larger concepts addressed here involve working with others through the entire process of making. This collaboration includes brainstorming, trial and error, making, implementing, and achievement of a task. Students in this space wrestled with their ideas within themselves and with their partners. They also had to think for themselves, but when put into practice needed to test if their ideas would actually work with the materials provided and the time allowed.

The time spent in the makerspace depended on each participant's free period(s). Participants were able to select from the cardboard challenge or another project of their choosing. Two students picked the challenge, and one student worked within the greenscreen room. It would seem that access to the makerspace during a free period resulted in more students using the space. If students had this time during each school

day, makerspace projects would increase and more learning would take place outside the traditional classroom.

The researcher has only been working in the school setting for ten years, but has already seen a shift in the way schools are teaching and the way students are learning. Many schools are already immersed in STEM, STEAM, Project-Lead the Way, and makerspaces; these spaces are not only in the library but have been implemented in classrooms as well. There is a large push for students to be active in the learning process instead of functioning as memorizing machines or test takers (Smay and Walker, 2015). For example, students today are likely to be more interested in making a movie than in watching one. Learners want to learn specific skills that will help them for life after high school and college. The shift starts with teachers accepting the fact that a traditional lecture with note-taking class setting isn't reaching our students. If teachers continue to educate themselves with the best practices and acknowledge the fact that students of this generation do not learn in the same ways previous generations did, a hands-on approach to learning would be visible in every school. A makerspace is a step towards the hands-on, active learning that students love. This maker movement is not leaving education any time soon and continues to have an impact on students and teachers in regard to creating, collaboration, innovation, and learning.

Recommendations

Learning is such a large part of one's life. Given the prior research previously discussed in this study, the data collected by this researcher, and the results of this study there is room for future development. Inclusion of three participants worked well for this study, but offering more than one challenge to students would be beneficial. Other

challenges students could pursue in the makerspace could include, a stop-go motion movie, bead making, or building with Legos, to name a few. Also, since the makerspace was new to students, it would have helped if modeling was used with the participants. Modeling could take the form of an adult showing others how to duplicate or make a certain item. Or in the case in which the student did not wish to have demonstrations, modeling could be students watching a tutorial about how a certain process is completed. In a library makerspace, it is common to see teacher librarians demonstrating how to use the tools in the space or guiding students in a step-by-step fashion (Sullivan, 2015).

For a high school library, limited time and space can be an issue of concern. At times, participants in the makerspace were torn between completing class homework and working on their selected project. If students are choosing to be in the library during their free periods, additional research may need to focus on whether the makerspace becomes a distraction or an added learning experience for the student. Another issue to address through future research would be how much time and space is needed to properly maintain a makerspace throughout the school year. crowding of makerspaces during students' free period. How can one teacher librarian or one small area meet the needs for everyone? One solution could be for the teacher librarian to start a makerspace club before or after school to gather students interested in it while also reserving space for this club. As the teacher librarian, it is important to provide students with with the opportunity to make. The researcher consulted her principal and ensured him that a makerspace club would be in the best interest of the school. This club could meet before or after school. The makerspace is not a requirement of the school's curriculum but is an extension of the student-centered library program.

Questions

This research study began as a single idea, bloomed into a study of one high school's new makerspace, and has sowed several ideas for future studies. First, the makerspace can be an area of little, some, or lots of instruction by the teacher librarian. The researcher questions what would evolve within the school if the teacher librarian held a makerspace club with guided instruction. Would more objectives from the Iowa Core be met? Would other teachers want to be involved? Would the library's makerspace turn into classroom makerspaces?

More importantly, there are many studies and authors examining the topic of makerspaces. Each author has his or her own opinion regarding how to operate such a space. In all my research prior to starting one in my own library, not one single author stated there was a correct way of implementing a makerspace. For this study, it was important to remind myself that the library's makerspace was in its beginning stages and did not need to be perfect because no makerspace is.

Future Studies

For anyone researching the creation of a makerspace, the researcher would highly suggest visiting as many school and public library makerspaces as possible. For example, the researcher explored, played in, and asked questions about makerspaces at an elementary, middle, and high school, along with visiting the Cedar Rapids and Marion Public Libraries and Grant Wood AEA. Next, the researcher would research learning standards and benchmarks that directly relate to one's state, school district, or particular grade level such as the Iowa Core. Future studies could also benefit from alignment to not just the Iowa Core but also the AASL Standards for the 21st Century Learner and ISTE student

standards. If implementing a makerspace is possible for your school's library and budget, plan where it will be, what will be included in the space, what rules will work best for the space, and who will manage the space while it is in use. The researcher was not prepared well enough for the actual preparation time needed to create the physical space.

The researcher believes a makerspace is successful when the teacher librarian believes that the power of play is connected to learning. Next, the researcher was open to mistakes, took responsibility for students' confusion as to what the space was for, and wasn't afraid of the actual mess it made in the middle of the library. The researcher will continue to grow the space with new tools and ideas. Also, the researcher would like to create a teen advisory committee. library committee plan. The researcher envisions this library's makerspace being managed by a teacher librarian, but also allowing students to decide what would work best for them. After all, the library makerspace was my idea in my role as the teacher librarian, but the students deserve credit for the learning they have gained while in the space.

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APPENDIX A

OBSERVATION RUBRIC

Iowa Core Standard	Always	Sometimes	Never
Standard 21.9-12.TL.1 Demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.			
Additional Notes			
Standard: 21.9–12.TL.2 Uses digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others.			
Additional Notes			
Standard: 21.9–12.TL.3 Apply digital tools to gather, evaluate, and use information.			
Additional Notes			

Standard: 21.9–12.TL.6 Demonstrate a sound understanding of technology concepts, systems and operations.			
Additional Notes			
Standard: 21.9–12.ES.4 Demonstrate initiative and self–direction through high achievement and lifelong learning while exploring the ways individual talents and skills can be used for productive outcomes in personal and professional life.			
Additional Notes			

APPENDIX B

INTERVIEW QUESTIONS FOR STUDENTS

Introduction: Hi, I'm your teacher librarian, Mrs. Marshall. I am studying makerspaces and their connection to learning standards in relation to the Iowa Core Standards. Please note that I will preserve your anonymity. I have already formally asked you if I could record this interview. For the study, do I have your permission to record this interview? Please know you can ask me any question as we go that is relevant to this study. You may request that I stop recording at any time during the interview.

Warm-up: What draws you into this makerspace? Why do you come here? How often do you visit the library in any given week? Why do you visit the library?

Body: What is your favorite part/item about the makerspace? Are you working on anything in particular? If so, can you please describe this for me? Are you working with others? If so, how many people? Do you have a purpose for this project? Explain. Explain what skills are needed while working in this space. What do you think about while using this space? What are you learning by making in this space? Explain if you are or do not think you are learning in this space. Are you proud of your work in this space? Explain if you are or are not. What makes you want to be creating in a makerspace? What would improve the makerspace and why?

Cool-off: It has been wonderful to talk to you about your experience in the makerspace. Your opinions are very valuable to this study and to the school.

Closure: Thank you so much for taking time out of your school day to discuss the makerspace with me. Thank you.

APPENDIX C

INTERVIEW QUESTIONS FOR TEACHERS

Introduction: I am studying makerspaces and their connection to learning standards such as STEAM. Please note that I will preserve your anonymity. I have already formally asked you if I could record this interview. For the study, do I have your permission to record this interview? Please know you can ask me any question as we go that is relevant to this study. You may request that I stop recording at any time during the interview.

Warm-up: What draws you into this makerspace for your classes? Why do you allow class projects to use the makerspace? What's your purpose for using the green screen as part of the makerspace?

Body: What have you or are you working on anything in particular in the makerspace? If so, can you please describe this for me? Are you working with other teachers? If so, how many teachers? Do you have a purpose for this project? Explain. Explain what skills are needed while working in this space. What do you think about while using this space? What are you learning by making in this space? What makes you want to bring classes into the makerspace? What would improve the makerspace and why?

Cool-off: It has been wonderful to talk to you about your experience in the makerspace. Your opinions are very valuable to this study and to the school.

Closure: Thank you so much for taking time out of your school day to discuss the makerspace with me. Thank you.

APPENDIX D

RECRUITMENT EMAIL

Dear Guardian(s),

Hello, my name is Tracie Marshall. I am the teacher librarian at Xavier High School. I am in the process of finishing my master's degree in the division of School Library Studies at the University of Northern Iowa. One of my degree requirements is to conduct a research study. My goal in this research study is to make connections with creativity and learning while students are in a library makerspace. I plan to share my findings with other teacher librarians in this state so that they can begin the process of creating a makerspace in their libraries.

For my data collection, I hope to directly observe and interview four students at Xavier. These direct observations and interviews will not take place during class time. I will directly observe your child for one week and interview him or her for 20-30 minutes. Participation is voluntary and will not be assigned a grade like a class would be.

If your child is willing to participate and you give consent for him or her to take part in this study, please sign the permission form I sent home with your child today. Your child will then return it to me, Tracie Marshall.

If you have any questions or concerns, please contact me or my faculty advisor:

Tracie Marshall
319-294-6635 ext. 397
tracie.marshall@xaviersaints.org

Dr. Joan Taylor, Research Advisor, School Library Studies
319-273-2192
joan.taylor@uni.edu

Also, feel free to contact the office of the IRB Administrator, University of Northern Iowa, at 319-273-6148, for answers to questions about the rights of research

participants and the participant review process. Thank you for your consideration in this matter.

I am fully aware of the nature and extent of my child's participation in this project as stated above and the possible risks arising from it. I hereby agree to allow my son/daughter to participate in this project. I have received a copy of this form.

_____ _____

(Signature of parent/legal guardian) (Date)

_____

(Printed name of parent/legal guardian)

_____

(Printed name of child participant)

_____ _____

(Signature of investigator) (Date)

_____ _____

(Signature of instructor/advisor) (Date)

APPENDIX E

UNIVERSITY OF NORTHERN IOWA

HUMAN PARTICIPATION REVIEW

INFORMED ASSENT

FOR OLDER CHILD APPROXIMATELY 14-18 YEARS OLD

Project Title: Makerspaces and the Iowa Core: Connections in a High School Library

Name of Principal Investigator: Tracie Marshall

I, _____, have been told by one of my guardians that I have his or her permission for me to participate in a project about my creativing and learning while using a makerspace.

I understand that my participation is voluntary. I have been told that I can stop participating in this project at any time. If I choose to stop or decide that I don't want to participate in this project, nothing bad will happen to me.

_____ _____

Name Date