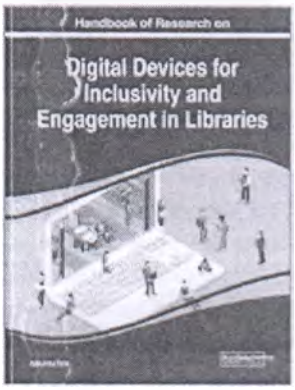

Library Markers Space in Academic and Public Libraries

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Abstract

This chapter examines the library markers space in academic and public libraries. These spaces are specifically designed to meet the unexpressed needs of library users and to influence them to profitably engage in the library by creating physical or digital objects, which are open for the free use of all library users. Library makers space enables graphic arts, web design, and animation, and assists students in their projects that involve digital images. Nevertheless, factors such as lack of technical skills, inadequate power supply, and lack of trained manpower distort the application of library markers space in academic and public libraries.

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Introduction

The University system is a multi-dynamic system been an institution that shares information and knowledge and it is a centre for discovery. The University also provides opportunity for skill acquisition and development of the students in various categories. As a result, in the word of Radniecki and Klenke (2017),universities look for ways to encourage innovation and entrepreneurship, and many academic libraries have begun providing access to maker resources and services. DeLaMare Science & Engineering Library became one of the first academic libraries to provide maker resources and services to anyone, regardless of discipline or even

university affiliation. Therefore, a makerspace is only as vital to innovation and collaboration as its users are educated and skilled to use it. Users needed to learn how to 3D model and design in order to 3D print their own creations. They needed design and editing skills, such as Photoshop and Illustrator, to create complex designs and prototypes on the laser and vinyl cutters. Programming and hardware development skills were necessary to prototype on common makerspace electronics like Arduinos, Lego Mindstorms robotics kits, and Raspberry PisRadniecki and Klenke (2017). According to Makerspace Playbook (2013), makerspace is a physical place set aside for creative hands-on activities/ actions/ endeavors ranging from Arts and Handcrafts to Mechanics, Electronics, Web and App Development and more.

The desire to meet the unexpressed needs of our library users and to influence them to patronize and profitably engaged in the library gave birth to the idea of makerspace known as "Digital Photography and Arts Makerspace (DPAM). Since the first official makerspace convened six years ago in a library in upstate New York, libraries have remained an ideal setting for makerspace events across the country. Many offer community resources like 3D printers, software, electronics, craft and hardware supplies, and more. One could argue that the phenomenon of makerspaces has led to a revitalization and reimagining of libraries in a digital world. As the means of circulating and accessing digital information outside of libraries continue to grow, this renaissance for the library as a place to gather, create, and collaborate has led to benefits for the host facilities just as much, if not more, than participants. Like book clubs, workshops, and other group meetings, hosting a makerspace alongside traditional offerings in a library is fast becoming the hands-on approach to learning and developing new skills. Many libraries at colleges and universities have incorporated program-specific makerspaces into their campus curriculum, bringing students together around a topic such as robotics or a particular fine art technique. The main objective of DPAM) is to create a community of library users for creative exploration using a variety of technology tools and process within the library environment. Specifically, Support the learning and the use of emerging technologies in the library, to connect the university community to the library, market the library, share and disseminate innovative ideas and for the production of digital information.

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Library Markers Space in Academic and Public Library

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Abstract

This study examines the Library Markers Space in Academic and Public libraries. These spaces are specifically designed, aimed at meeting the unexpressed needs of library users and to influence them to profitably engage in the library by creating physical or digital objects, which are open for the free use of all library users. Library makerspace enables Graphic arts, web design and animation and assists students in their projects that involve digital images. Nevertheless, factors such as lack of technical skills, inadequate power supply and lack of trained manpower distort the application of Library Markers Space in academic and public libraries

Keywords: Makerspace, Academic library, Public library,

Word Count: 100

Introduction

The University system is a multi-dynamic system been an institution that shares information and knowledge and it is a centre for discovery. The University also provides opportunity for skill acquisition and development of the students in various categories. As a result, in the word of Radniecki and Klenke (2017), universities look for ways to encourage innovation and entrepreneurship, and many academic libraries have begun providing access to maker resources and services. DeLaMare Science & Engineering Library became one of the first academic libraries to provide maker resources and services to anyone, regardless of discipline or even university affiliation. Therefore, a makerspace is only as vital to innovation and collaboration as its users are educated and skilled to use it. Users needed to learn how to 3D model and design in order to 3D print their own creations. They needed design and editing skills, such as Photoshop and Illustrator, to create complex designs and prototypes on the laser and vinyl cutters. Programming and hardware development skills were necessary to prototype on common makerspace electronics like Arduinos, Lego Mindstorms robotics kits, and Raspberry Pis Radniecki and Klenke (2017). According to Makerspace Playbook (2013), makerspace is a physical place set aside for creative hands-on activities/ actions/ endeavors ranging from Arts and Handcrafts to Mechanics, Electronics, Web and App Development and more.

The desire to meet the unexpressed needs of our library users and to influence them to patronize and profitably engaged in the library gave birth to the idea of makerspace known as "Digital Photography and Arts Makerspace (DPAM). Since the first official makerspace convened six years ago in a library in upstate New York, libraries have remained an ideal setting for makerspace events across the country. Many offer community resources like 3D printers, software, electronics, craft and hardware supplies, and more. One could argue that the phenomenon of makerspaces has led to a revitalization and reimagining of libraries in a digital world. As the means of circulating and accessing digital information outside of libraries continue to grow, this renaissance for the library as a place to gather, create, and collaborate has led to benefits for the host facilities just as much, if not more, than participants. Like book clubs, workshops, and other group meetings, hosting a makerspace alongside traditional offerings in a library is fast becoming the hands-on approach to learning and developing new skills. Many libraries at colleges and universities have incorporated program-specific makerspaces into their campus curriculum, bringing students together around a topic such as robotics or a particular fine art technique. The main objective of DPAM) is to create a community of library users for

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Literature Review

History of Making

To be a "maker" is to embrace a culture of experimentation and innovation. Makers are garage inventors, hackers, and collaborators. As Anand Giridharadas states in his 2011 *New York Times Magazine* article "The Kitchen-Table Industrialists:"

> "...the American romance with making actual things is going through a resurgence. In recent years, a nationwide movement of do-it-yourself aficionados has embraced the self-made object. Within this group is a quixotic band of soldering, laser-cutting, software programming types who, defying all economic logic, contend that they can reverse America's manufacturing slump. America will make things again, they say, because *Americans* will make things — not just in factories but also in their own homes, and not because it's artisanal or faddish but because it's easier, better for the environment and more fun."

The idea of "making" has certainly been around for a long time, but the term "maker" as we understand it now wasn't really used until the existence of *MAKE* Magazine. *MAKE* Magazine launched in 2005. The publication is devoted to people and projects that bring the DIY mindset to the technology movement. In 2006, the first Maker Faire was born. According to the Maker Faire website, Maker Faires are "...primarily designed to be forward-looking, showcasing makers who are exploring new forms and new technologies. But it's not just for the novel in technical fields; Maker Faire features innovation and experimentation across the spectrum of science, engineering, art, performance and craft." Maker Faires invite Makers to showcase innovative projects, and invite participants to learn and experiment with different hands-on activities. Maker Faires are now held annually in the Bay Area and New York City, and Mini Maker Faires are held all over the world.

Conceptual definition of MakerSpace

There is no single definition of the word "makers". There are different perception towards its meaning. As Morin (2013) indicated, "You can think of makers as people creating physical things using the Web." According to Dougherty (2012), everyone is a maker. A maker

can be someone who is gardening or someone who is building electronic toys. The rise of the maker movement stems from people's growing interest in engaging with physical objects and making things rather than just consuming them. More so, Wang, Wang, Wilson and Ahmed (2016), mentioned that three factors have helped build the maker movement. The first is the emergence of digital fabrication tools and software such as 3D printers, 3D scanners, laser cutters, Computer Assisted Design (CAD) software, etc. Such formerly expensive industrial tools have become personalized and available to individuals at a reasonable price. Second is the collaboration and innovation fostered by the Internet. Individual makers can now connect with others via the web to share ideas, learn technologies, create their communities, and work on projects together. The third and final element is the emergence of increasingly accessible and flexible factory services such as circuit manufacturing. Factories around the world can now take orders of any size and scale (Anderson, 2013). Makerspaces are part of a growing movement of hands-on, mentor-led learning environments to make and remake the physical and digital worlds. They foster experimentation, invention, creation, and exploration through design thinking and project-based learning. The movement aligns with President Obama's Educate to innovate initiative and his call to "think about new and creative ways to engage young people in science and engineering (and)..encourage young people to create and build and invent—to be makers of things, not just consumers of things." (Obama, 2009) in Institutes of Museum and Library studies (2014)

According to Loerstcher, Preddy, and Derry (2013), makerspace is a place to reinvent old ideas with new conceptual frameworks, utilize advancements in thinking and doing, and investigate and construct a hybrid of fine arts, sciences, crafts, industrial technologies, foods, inventions, textiles, hobbies, service learning, digital media, upcycling, STEM/ STEAM, and DIY (do it yourself) and DIT (do it together) concepts. In the word of Marsh, et al. (2017), creativity and innovation are key to engagement in makerspaces, and the concepts are closely intertwined. We could not be creative without some sort of innovativeness, something new or unusual. Innovation does not come about without creative thinking, and depending on how innovation is defined, it requires creative actions. Some scholars do not make a distinction between innovation and creativity (Georgsdottir, Lubart, & Getz 2003; Weisberg 2003).

Makerspaces are defined more by what they enable than what they actually look like. A makerspace can take many forms, from a mobile cart loaded with crafting supplies to a room full

of computers, tools, and tables. Makerspaces are a combination of a traditional lab, art room, shop and conference room, where hands-on learning takes place and people are encouraged to collaborate to turn ideas into reality. Makerspaces are all about getting hands-on and creating real-world projects using the tools and expertise on hand. The need for makerspaces comes down to two things (1) an urgent need for employees in STEM fields in the future and (2) the impact they have on student learning, including the development ofproblem-solving and critical-thinking skills (Pereira, n.d). Morin (2013) affirmed that libraries and museums have long embracing the maker movement. Sections of physical space have been turned into makerspaces and programs such as craft nights have been introduced into local communities. The growing shift from consumers of things to makers of things is going to have a transformative impact on the economy and future. According to Wang, et al. (2016), a makerspace is usually equipped with tools and technologies for people to get together to work on projects and learn practical skills from each other. The Makerspace Playbook states that:

> Makerspaces come in all shapes and sizes, but they all serve as a gathering point for tools, projects, mentors and expertise. A collection of tools does not define a Makerspace. Rather, we define it by what it enables: making. (2013).

The main focus of a makerspace is learning and education. A makerspace enables learners to become producers of knowledge, rather than consumers of knowledge. It encourages collaborative, hands-on, project-based, and experiential learning. Makerspaces are usually created in a community environment, such as a community centre, library, business, university or K-12 school campus (Wang, et al., 2016). According to Educause (2013), "A makerspace is a physical location where people gather to share resources and knowledge, work on projects, network, and build. Makerspaces provide tools and working room in a community environment - a library, community center, private organization, or campus".

Makerspaces provide access to tools, education, and community. They are great facilities for experimenting with emerging technologies, project development, idea prototyping and self-directed learning and discovery. Because of their hands-on learning nature, makerspaces have been quickly adopted in STEM education (science, technology, engineering, math). However, makerspaces are not only for scientific and technological activities. Increasingly, makerspaces serve the educational need in fields other than STEM (Wang, et al., 2016). The Library as Incubator Project (2012) defines makerspaces as, "collaborative learning environments where

people come together to share materials and learn new skills", and concludes that, "makerspaces are not necessarily born out of a specific set of materials or spaces, but rather a mindset of community partnership, collaboration, and creation."

According to the 2014 New Media Consortium (NMC) Horizon report, there has been a growing interest in makerspaces as a result of the broad integration of creative processes and hands-on learning. Institutional leaders are increasingly viewing their students as creators rather than consumers; the expert panel expects this trend to peak within three to five years. In the 2015 and 2016 NMC Horizon reports, makerspaces were identified as one of the mid-term (2-3 years) key trends accelerating technology adoption in higher education. The Maker Manifesto (Hatch 2013) attempts to identify some of the principles that are representative of the 'Maker Movement':

MAKE: – Making is fundamental to what it means to be human. We must make, create and express ourselves to feel whole. There is something unique about making physical things. These things are like little pieces of us and seem to embody portions of our souls.

SHARE: – Sharing what you have made and what you know about making with others is the method by which a maker's feeling of wholeness is achieved. You cannot make and not share.

GIVE: – There are few things more selfless and satisfying than giving away something you have made. You must have access to the right tools for the project to hand. Invest in and develop local access to the tools you need to do the making you want to do.

LEARN: – You must learn to make. You must always seek to learn more about your making. You may become a journeyman or master craftsman, but you will still learn, want to learn and push yourself to learn new techniques, materials and processes. Building a lifelong learning path ensures a rich and rewarding making life and, importantly, enables one to share.

TOOL UP: – You must have access to the right tools for the project to hand. Invest in and develop local access to the tools you need to do the making you want to do. Tools for making have never been cheaper, easier to use or more powerful.

PLAY: – Be playful with what you are making, and you will be surprised, excited and proud of what you discover.

PARTICIPATE: – Join the Maker Movement and reach out to those around you who are discovering the joy of making. Hold seminars, parties, events, maker days, fairs, expos, classes and dinners with and for other makers in your community.

SUPPORT: – This is a movement, and it requires emotional, intellectual, financial, political and institutional support. The best hope for improving the world is us, and we are responsible for making a better future.

CHANGE: – Embrace the change that will naturally occur as you go on the maker journey. Since making is fundamental to what it means to be human, you will become a more complete version of you as you make (Hatch, 2013).

Makerspaces are of several types including Hackerspaces, Fablabs, Creative space, Techshops etc, each having their own unique characteristics. A hackerspace is a community operated workspace where people with common interests, usually in computers, mass production, science, technology, digital or electronic art, can meet, socialise and collaborate. Hackerspaces have also been compared to other community operated spaces with similar aims and mechanisms such as Fab Lab, started in 2006 by a MIT Professor Neil Gershenfelh, which provides up-to-date designs like electronic appliances, laser cutters, routers, etc., appropriate for makers allowing them to generate anything. Basically it is a platform for learning and innovation. They are likely to be smaller, i.e., 1000-2000 sq ft when compared with other spaces (Hussain and Nisha, 2017).

MakerSpaces in Libraries

A Makerspace is an evolutionary step in library facilities' design and programming." Incorporating a whole host of activities like robotics, engineering, sewing, coding, carpentry, cooking, electronics, rockets, furniture making, anything that sparks curiosity and engages critical thinking can be part of the maker movement (Loerstcher, Preddy, and Derry, 2013). The main function of makerspaces in the library is that they connect different members (Library users) of academic discipline, create a neutral space where people can share creative ideas, help students acquire and refine news skills in digital photography, graphic arts, web design and amination, assist students in their projects that involve digital images and help build relationship with innovative companies for funding and research development. More so, along with the skills necessary to fully utilize equipment, programs, and services in the makerspace, there are complementary skills which help support many of the projects being developed. One such knowledge and skill set is intellectual property. The library saw many never-before-created objects being 3D printed and built in its space and as longtime experts in intellectual property, saw the opportunity to provide avenues for users to learn about patents and trademarks

(Radniecki and Klenke, 2017). Tashjian (2014) stated that "makerspaces are shifting educational and public organizations from being places where things are made or information is found to places where knowledge and ideas are developed and imagination and creativity are fostered." As an educational and public organization, the library is also undergoing this transformative shift. Tod Colegrove, director of the DeLaMare Library, said that a noisy library with a messy innovation workshop is actually a return to the library's origin (Rutkin, 2014). According to Wang, et al. (2016), learning from books is no longer the only way of acquiring knowledge. Modern society requires students to have highly specialized skills in technology. The best way to acquire this kind of knowledge and skills is through hands-on learning.

The idea of making or makerspaces in libraries is not new. The Manitoba Crafts Museum and Library was created in 1933 for preserving the heritage of craft culture of Manitoba. The library was also used as a meeting place and provided resources for learning craft skills such as knitting and quilting (Manitoba Crafts Museum and Library, 2014). Fleming (2014) mentioned that "In 1960, the Nebraska Public Library Commission hosted a variety of special activities, including creative arts, which were organized by area groups." The first tool lending library, Rebuilding Together Central Ohio Tool Library, was founded in 1976 in the City of Columbus, Ohio. Today, this unique tool library is open to the people of Franklin County, lending out 200 varieties and close to 4,500 tools. The community can borrow tools and access a variety of informative resources about making (Rebuilding Together Central Ohio, 2014). Makerspaces come in all shapes and sizes. Some are fixed rooms or structures, and some are temporary. Whether a Makerspace contains thousands of dollars' worth of equipment, or is simply a cart full of tools, the goal of a Makerspace is to facilitate making. The reality for most libraries is that we don't have a dedicated space in which to make stuff. But we do have the capability to encourage making at our libraries. Making means learning through trial and error, through practical application, and through hands-on experience in a social environment. Making means giving access to communities to grow and create something better Loerstcher, et al., 2013).

Historically, libraries have encouraged life-long learning through their collections and programs. This, combined with the revived interest in making, has led to the emergence of a new type of library space, one equipped with new digital tools such as 3D printers and laser cutters. The Fayetteville Free Library, the New York Public Library, the Westport Public Library in Connecticut, the Chicago Public Library, and the DeLaMare Science and Engineering Library at

the University of Nevada, Reno are all examples of this trend. These library makerspace pioneers are igniting a new wave of library transformation in the 21st century.

The establishment of library is to support the mission and vision of her mother institution such as to provide teaching, learning and research for knowledge and skills acquisition. The library also have her role to play in the provision of her services to clients. Therefore, library service pledge to utilize innovative technology and strategies in her services, library strategic plan, create a modern facility that leverages state-of-the-art space design, technology and innovation to meet the needs of her users, ensure that the library's infrastructure (technology, tools, staff), supports 21st century teaching and learning needs (Wong-Welch and Keven, 2018). The goal of makerspaces in the library is achievable based on its consonance with that of the library. The goal of makerspaces aims at reducing barriers so that people can learn and start creating their resources and collections. According to Wong, Makerspaces are, "places that help cultivate creative interests, imagination, and passion by allowing participants to draw upon multiple intelligences. They are an effective means of applying knowledge, and they tap new resources for learning (Hussain and Nisha, 2017). Bagley (2012) explained that "the maker movement in libraries is about teaching our patrons to think for themselves, to think creatively, and to look for do-it-yourself solutions before running off to the store." Therefore, a key role for a library makerspace is to help create creative people. Throughout the process of creating this learner-centered and multifaceted Makerspace, according to Branigan-Pipe (2017) the teachers involved gained:

(a) Stronger understanding of the complexity in creating a learning environment that incorporates the Reggio Emilia and Montessori and Waldorf Methods in a public-school setting and how this connects to the student-centred approach and current pedagogies
(b) Valuable collaboration and team building skills associated with design thinking, action research, teacher inquiry, problem solving and the creation of lessons that were cross-curricular and used a constructionist approach
(c) A greater understanding of networking and professional development through social networking tools like Twitter, Blogging and Instagram as well as presentation skills at conferences and showcase events
(d) A stronger understanding of Makerspace tools and projects and implementation in a meaningful way

(e) A meaningful way to connect practice to pedagogy

(f) Opportunity to practice creating classroom lessons that focused on a variety of conceptual frameworks and being able to articulate each framework depending on the context, the environment, the teacher and the learner

(g) The opportunity to create teacher through the implementation of lessons and experimentation with the tools themselves

(h) A developed (ongoing) framework to create a human centric makerspace

A case study report by Pryor (2014) on "Makers in the library: studies of 3D printers and maker spaces in library setting showed that, academic library makerspaces have reported providing workshops, access to learning aids, and consultations to help users 3D print, but none focus on how workshops or consultations are being conducted, what content is being taught, and whether any of the avenues of information provision were successful. A workable 3D printers according to Radniecki and Klenke (2017) are essentially the same as paper printers. A file is uploaded, for example, a STL file instead of a Word document, and the user chooses the command to print. Depending on the model of 3D printer, the user may also have to adjust some of the physical properties of the printer including loading filament, calibrating the printer, and other conditions depending on the job being printed. 3D printing allows for more authentic exploration of objects that may not be readily available to schools, including fragile items like fossils and artifacts. The exploration of 3D printing, from design to production, as well as demonstrations and participatory access, can open up new possibilities for learning activities.

This Makerspace classroom is separated into many spaces and at the time of the design, the space was inspired the Montessori approach of teaching that recognizes that space is an important part of the learning process and that learners need the opportunity to explore, experiment and have access to a variety of tools and resources. The following describes the initial spaces that were implemented:

(a) **MakerSpace:** A large part of the room is dedicated to a MakerSpace where students can build, engineer robots, take apart machines and co-create their own computers or devices.

(b) **Laptops:** One side of the room is reserved for group laptops, iPads and an Apple TV for sharing.

(c) **Design and Engineering:** There is a 3D Makerbot printer along with tablets and computers allocated specifically for design and engineering.

(d) **Math and Science:** There are two hubs – one for Science and one for Math exploration – with a shared Interactive Smartboard for small group activities.

(e) **Health and Fitness:** Here you will find a small herb garden and literature dedicated to healthy living, as well as a worm composter.

(f) **Social Justice and Critical Literacy:** There is a strong emphasis on Critical Literacy. Inquiry questions and Big Ideas provide the focus for exploration of Millennium Goals/United Nations Sustainable Goals and for both guided and self-directed learning.

(g) **Literacy:** A writing centre provides resources such as Livescribe Pens, Journals (for co-written topics) and a variety of choices for students to write and share at their level and interest.

(h) **Arts:** There is a ceiling-to-floor Green Screen for filming, along with a puppet display for drama. The piano and guitar are rarely quiet. Even during group inquiry time, students use self-directed breaks to paint or draw or listen to music. (Branigan-Pipe, 2017)

As the maker movement flourishes, libraries – especially public and academic libraries have embraced the opportunity to create makerspaces and programs serving youth and adults alike. More so, maker-focused programs inspire and empower people to make, create and learn new skills. Offering resources such as laser cutting, computer programming, 3D printing, self-publishing, welding and collaborative work spaces, maker-focused programs are helping new makers develop prototypes and business models and inspiring next-generation. There are collection of resources in library makerspaces. Reports showed that he DeLaMare Library currently provides access to a number of maker technologies and services. Larger equipment includes multiple 3D printers, Artec 3D scanners, a laser cutter, vinyl cutter, PCB milling machine, soldering bar, and sewing machine. The lending technology collection includes other items commonly found in makerspaces, such as Sparkfun Arduino Inventor kits, Raspberry Pis, hand tools, and a variety of virtual reality headsets including the Oculus Rift and HTC Vive. While some tools and technologies require little prerequisite knowledge to fully utilize, such as hand tools or even soldering irons, others demand complex skill sets in order to take advantage of their full capabilities (Radniecki and Klenke, 2017).

According to Anderson (2012), the rise of makerspaces as a concept began around 2005 with the beginning of *Make:* magazine and its promotion of creative projects and methods for making. The United States and internationally showcased the efforts of makers. Afterwords,

libraries began to host making activities in their programming options and to establish dedicated makerspaces. Librarians also began to recast some of the creative activities and devices already present in their buildings as making activities, such as video and audio capture, large format printing, art-related workshops, music recording spaces, and so forth. With an international network of makers already present and sharing their projects, techniques, and technologies, library staff members could build on their initial inspirations and develop larger makerspace programs (Burke, 2015).

Makerspace in the library meet the unexpressed needs of library users, influence them to patronize and profitably engaged in the library, woo library users to the library to remain relevant in the technological world. Makerspaces provide resources and students are guided on how to solve problems through creation, and also offer guidance and examples of products to inspire the learner to deeper understanding of the products. Reports has showed that the application of makerspaces mostly in academic and public libraries has been primarily guided by the environments in which they operate. While there are common elements to every makerspace, those in academic libraries do exhibit some differences. When academic library responses were isolated from the author's survey, they illustrate something of a different focus (Burke, 2015). In the word of Branigan-Pipe (2017), makerspace environment is collaborative in nature, and can occur at a school, a library, a classroom, a shared workspace, a community church, a garage, or a backyard – it is a space where individuals (who are interested in creating, making, fixing, talking, exploring, inventing, and discovering) get together, and it is usually done through self-motivation and direction, personal interest, and with a willingness to share, learn, and work with others regardless of age, gender, or ability. In creating a makerspace in the library, the following are required:

(a) Designated area away from learning areas or quiet reading areas
(b) There must be available power source
(c) Quality signage and storage
(d) Create easy access to materials and supplies
(e) Create a schedule to allow small groups or whole classes to use Makerspace
(f) Develop small Makerspace stations for multiple activities or
(g) Limit the Makerspace to a select few activities or
(h) Set up a 'maker cart' that can travel around the library or to classrooms

Study by Burke (2015) showed the 16 most common technologies and activities from academic library makerspaces such as websites, digital photos, programs, apps, and games. Arts and crafts, tinkering, and the well-represented category of "Other" have dropped from the list entirely. The contents of that "Other" list tended to include more physical making activities (such as button making, hand tool collections, and LEGOs), and may further point to an academic library makerspace tilt toward digital creation. It is possible that, at least among the surveyed libraries, academic makerspaces tend to be focused more on discipline-related projects that involve product modeling and prototyping for engineering, design, or marketing. That might account for the higher ranking of those activities. It might further indicate that academic library makerspaces tend to be created to meet curricular goals at an institution rather than as venues for independent discovery and creation activities. According to Burke (2015), other reasons why library staff members have decided to pursue makerspaces are:

(a) They exist to bring individual makers into a space with shared resources.
(b) They are spaces in which experienced makers can teaching skills and guide the progress of newer makers.
(c) They allow for the sharing ideas and designs not just within the makerspace, but outward to the larger world of makers.
(d) They enable individuals to collaborate on projects and bring multiple perspectives and skill sets together.
(e) They encourage individuals to experiment and discover through tinkering with technologies and products and to approach making with a spirit of play.

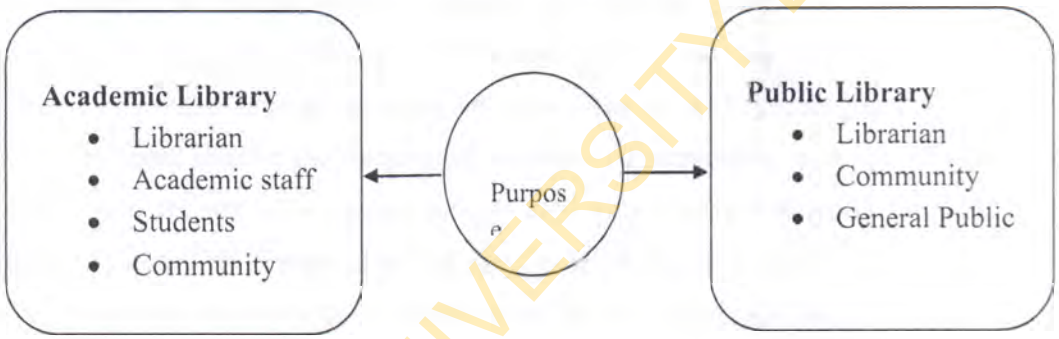
Moorefield-Lang (2015), analysed the user agreements of makerspaces in public and academic libraries. The study found that the makerspaces are a very exciting topic in the field of library science at present; the application of a maker learning space is still new to many libraries. The Mississippi Department of Education highlighted the basic steps for building makerspace resource library:

(a) Get at least one or two books geared towards maker educators to help expand knowledge
(b) Start building up a collection of makerspace picture books in an elementary library
(c) Add a variety of project books that can help students to build up maker skill sets
(d) Find books that can offer visual inspiration

(e) Make a list of all the tools and materials available in the makerspace - get a least one or two books on each of these tools.

The Conceptual Framework

Figure 1 is a representation of the conceptual framework for this study. As depicted, the four categories of librarian, academic staff, students and community are interconnected via purpose. The people in a Makerspace provide, request for, and dictate the means used, the means determine the activities that may be possible in the space, and the activities contribute to people's experiences which include their learning experiences. At the same time, the people and their interests, goals, and experiences dictate the activities that take place in a Makerspace, the activities determine which means are needed, and the means influence what people do in the space. Depending on the purpose behind the space, each Makerspace could be variably focused toward either the librarian, academic staff, students, the community, or combination of all.



Purpose as represented in the framework, the purpose of a Makerspace defines which aspect(s) the space focuses on. The purpose of a space could be librarian-focused, academic staff-focused, students-focused or community-focused, or some variable combination. All aspects of the framework always exist but sit at tension with the variable focus of the space. The purpose of a Makerspace could be defined when the space is initiated, such as Makerspaces in educational settings, which are set up for meeting educational needs or outcomes. The purpose could also be continually evolving as many spaces redefine their nature depending on the contexts they are situated in. Examples of such spaces include community spaces which are not set up for a particular reason but dynamically evolve.

MakerSpaces Theory

Theories of constructivism and constructionism by Jean Piaget's and Papert (1980)

This theory is based on Jean Piaget's theories of **constructivism** and **constructionism** by Papert (1980). Jean Piaget's theories of constructivism are being discussed and implemented as part of new pedagogies in the 21st century. Makerspaces are very popular in the 21st century learning context because such approaches are so closely linked to constructivist theorists whose research – for many decades – has pointed to the fact that when students are active participants in their learning through play and making, they are engaged in their own learning process. This, then, enables deep and meaningful learning to take place. As this resource aims to demonstrate, and as pointed out by Resnick (2015), that "just making things is not enough".

Lee Martin, of the University of California (2015), also points out in his detailed research on the Maker Movement in Education, that, the history of the adoption of computers in schools suggests a lurking danger: The Maker Movement that assumes its power lies primarily in its revolutionary tool set, and that these tools hold the power to catalyze transformations in education. Given the growing enthusiasm for making, there is a distinct danger that its incorporation into school settings will be tool centric and thus incomplete. There are many different approaches to making things, and some lead to richer learning experiences than others. Moreover, most involve the integration a variety of curriculum with many layers, real-world learning, and the use of a cross-curricular approaches using real-world problems and critical thinking. Ultanir (2012) researched and wrote a detailed description of the constructivist learning theories entitled, "*Constructivist Learning in Dewey, Piaget, And Montessori.*", Ultanir (2012) emphasizes that there are many connections to John Dewey's assertions that our experiences are vital to authentic learning; firstly, Jean Piaget asserted that the basis of learning is discovery, and secondly, Papert's research recognized and declared that that knowledge is not transmitted, but constructed – literally, through the process of making.

Piaget's theories of constructivism were inspired by the belief that children are not empty vessels to be filled with knowledge, but instead are active builders of knowledge (Igafo-Te'o, 2002). In Piaget's theory of constructivism, knowledge is not about information to be delivered, memorized, retrieved; it is an experience that is acquired through interaction with the world, people and things (Ackermann, 2001). One of the common threads of constructivism that runs across all these definitions is the idea that development of understanding requires the learner to actively engage in meaning-making. The real understanding is only constructed based on learners' previous experience and background knowledge. It maintains that individuals create or

construct their own new understandings or knowledge through the interaction of what they already believe and the ideas, events, and activities with which they come into contact. (Ultanir, 2012)

Constructionism theory

Constructionism, Makerspaces and deep learning go hand-in-hand, as recognized by Papert (1980) of Massachusetts Institute of Technologies (MIT), who developed a theory of learning based upon Piaget's constructivism. Papert (1980) asserts that, "children build their own intellectual structures with materials drawn from the world around them". What is different from Piaget's theories, however, is that Papert (1980) maintains that learning occurs through making rather than overall cognitive potentials and thus, his approach – *constructionism* – helps to understand how ideas get formed (Ackermann, 2001).

Noss and Clayson (2015) describe the concepts behind constructionism beautifully in their article ***Reconstructing Constructionism*** in saying, "when we build, we build with things – not just ideas ... if we design properly, the things we build with have an epistemic foundation – of 'powerful ideas'". Papert (1980) also asserts that, "children build their own intellectual structures with materials drawn from the world around them".

MakerSpaces in Academic Libraries

The library makerspace trend started with public libraries, but more and more academic libraries are recognizing the benefit of makerspaces and their relevance to their strategic mission. This emerging trend can bring faculty and students together across disciplines, facilitate collaborative and hands-on learning, encourage knowledge sharing and creation, and help academic libraries adapt to the ever changing needs of their community (Wang et al., 2016). Makerspaces in Academic library became important as they create opportunities for hands-on learning, co-working, STEM activities, prototyping, tinkering, and experiencing an open culture (Burke, 2015). Opara (2001) posits that the library stands in the same relationship to the society as the memory of an individual by making available and accessible to its users information required for teaching and independent study. The main purpose of an academic library as stated by Aina (2004) is to support the objectives of an academic environment in the areas of learning, teaching, research, and service.

Burke (2015), demonstrated and elaborated the rise of library makerspaces, making activities and technologies in library a makerspaces, profile of academic library makerspaces, and how makerspaces connect to learning in higher education, motivations for creating a makerspace, some considerations when planning a makerspace, and justification for an academic library makerspace. All libraries, the six significant categories for library makerspace creators were discussing, that is, supporting learning, encouraging collaboration, providing access, expanding library services, following the library's mission, and providing opportunities for individual creation. Jubb and Green (2007) observe that academic libraries have for centuries played critically important roles in supporting research in all subjects and disciplines within their host universities or colleges. Guskin (1996) notes that the use of university libraries promotes active learning, thus contributing to students' ability to think critically and work well independently or in group. An academic environment without a library is tantamount to a person without a brain. Okpala (2016), in his word has highlighted the concept of makerspaces and its apparent benefits in academic libraries in Nigeria. The findings of the study display that users attention is drawing towards library for fostering creativity and invention. Makerspaces offer highly rewarding services to students, faculty members, and staffers and make them learn new things, working with their peers, considering new ideas, exploring, tinkering, and inventing. Training and workshop opportunities for librarians were proposed to make them well equipped with makerspace skills.

In 2015, the Association of Research Libraries (ARL) conducted a survey of its 124 ARL member libraries to gather information for senior library staff to support decisions related to engagement with 3D printing, rapid fabrication and digitization technologies, and makerspaces in general. A Rapid Fabrication/Makerspace Services SPEC Kit (Association of Research Libraries, 2015) was developed based on the survey results. Among the 64 libraries that responded, offering makerspaces services appear to be of significant interest to ARL libraries, and a substantial majority of the responding libraries are currently engaged with makerspace service deployment. Respondent comments about the role of makerspace in their libraries are overwhelmingly positive: makerspaces are noted for fostering innovation, creativity, active learning, and scholarly communication etc. A number of respondents emphasized that the core competitive advantage of the library is not in providing hardware or simple physical space but in

creating an environment that combines service, space, and expertise to foster individual and collaborative "investigation, interrogation, and learning through doing" (Wang et al., 2016).

According to Wang et al. (2016) in the SPEC kit, ARL also outlined the strategic relevance of makerspaces to research libraries. First, makerspaces represent a unique use of library space. The assessment and renovation of libraries' use of space has been recognized as a current strategic issue for libraries in general. Second, libraries are increasingly engaging with data management. Digitization and fabrication technologies both make use of and produce research data. Third, fabrication is becoming increasingly important throughout the various stages of research lifecycles. There is a clear trend towards adoption in higher education generally. These technologies may be used early on as part of prototyping for research or to embed sensors for research data collection, or later on as part of analysis or research collaboration.

MakerSpaces in Public Libraries

Public libraries have always played a very important role in facilitating literacy and learning. By providing the general public with access to new technologies, public library makerspaces can help develop a new generation of workers who will build a stronger economy (Scott, 2012). Many public libraries according to München (2001) have responded to the challenge of the electronic revolution and taken the opportunity to develop services in new and exciting ways. There is, however, another side to this story. The United Nations Human Development Report 1999, while stating that the Internet is the fastest growing tool of communication ever, revealed that South Asia with 23.5% of the world's population has less than 0.1% of the world's Internet users. A quarter of the countries of the world has less than one telephone for every hundred people. To take advantage of the opportunities information and communications technology present there is a basic need for literacy, computer skills and a reliable telecommunications network. The risk of a growing gap between the information rich and the information poor has never been greater. This gap is not just an issue between countries at different stages of development but also between groups and individuals within countries.

Libraries still struggle with the outmoded public perception that we exist primarily to provide access to information. Additionally, the traditional concept of literacy is no longer adequate, which has implications for libraries in terms of what community members need from us. As stated by Scott in "Making the Case for Public Library Makerspace, "One of the

traditional roles of the public library in society is facilitating the creation of knowledge in our communities. Promoting literacy through instruction has long been a part of the librarian's job. Today, the concept of literacy encompasses much more than just reading and writing; it has evolved into "transliteracy," commonly defined as the ability to read, write and interact across a range of platforms and tool." (Scott, Sarah. Public Libraries Online. Public Library Association, Nov. 11, 2012. Online. February 14, 2014.) Additionally, there is a growing concern in the U.S. that young people today are not gaining the skills they need to be successful in a 21st century workforce. Making has been shown to be an effective tool to help young people build 21st century skills and inspire them to consider STEM-focused careers. By embracing the maker movement, libraries can increase their relevance to the community by becoming a place that helps provide youth with the skills they will need to succeed in the workforce.

Public libraries have an exciting opportunity to help to bring everyone into this global conversation and to bridge what is often called 'the digital divide'. They can achieve this by providing information technology for public access, by teaching basic computer skills and by participating in programmes to combat illiteracy. However, to fulfil the principle of access for all, they must also continue to maintain services that provide information in different ways, for example, through print or the oral tradition (München, 2001). These are likely to remain of vital importance for the foreseeable future. While becoming the gateway to the electronic information world should be a key objective for the public library, every effort must be made not to close other doors through which knowledge and information can be provided. According to IFLA/UNESCO Public Library Manifesto (1994) define public library as:

> 'the local gateway to knowledge provides a basic condition for lifelong learning, independent decision-making and cultural development of the individual and social groups.'

Public library provides access to knowledge, information and works of the imagination through a range of resources and services and is equally available to all members of the community regardless of race, nationality, age, gender, religion, language, disability, economic and employment status and educational attainment. The goals and objectives of public library embrace makerspaces as its centre on knowledge with the use of information technology. In a Public library setting, library makerspaces traditionally catered for craft-focused activities like knitting, crocheting and sewing. The primary purpose of public library is to achieve this by providing resources and services in a variety of media to meet the needs of individuals and

groups for education, information and personal development including recreation and leisure. They have an important role in the development and maintenance of a democratic society by giving the individual access to a wide and varied range of knowledge, ideas and opinions (München, 2001).

The evolution of technology and resurgence of do-it-yourself culture has led to a change in programming offered in some of these spaces toward a focus on science, technology, engineering and mathematics (STEM) (Slatter and Howard, 2013). In public libraries, makerspaces and other creative places are emerging to meet the creative, social, educational, and innovation needs of individuals and communities. According to Barniskis (2016), these spaces are participatory social and spatial arrangements aimed at least in part at creating physical or digital objects, which are open for the free use of all library patrons, irrespective of the types of workshops, tools, staffing, materials created, or location. Reports of such spaces often present them as "empowering," but little has yet been published on library user or personnel perceptions of this presumed empowerment. Britton (2012) emphasised that makerspaces are places where people come together to create, collaborate, and share resources and knowledge – an idea and concept that fits perfectly with the mission and vision of public libraries. With the use of makerspaces, library users are not merely consumers of information, they are also creators of information. In the word of München (2001), learning does not end with the completion of formal education but is, for most people, a lifelong activity. In an increasingly complex society people will need to acquire new skills at various stages of their life. The public library has an important role in assisting this process.

München (2001), further recommend that the public library should provide material in the appropriate media to support formal and informal learning processes. It should also help the user to make use of these learning resources effectively as well as providing facilities that enable people to study. The ability to access information and make effective use of it is vital to successful education and, where possible, public libraries should co-operate with other educational organizations in teaching the use of information resources. Where adequate library facilities exist to support formal education the public library should complement them rather than duplicating library provision available elsewhere. This process of information provision in the support of formal and informal learning process could be said to be one of the social role of public library. According to München (2001), the public library in the library makerspaces has

an important role as a public space and meeting place. This is particularly important in communities where there are few places for people to meet. It is sometimes called 'the drawing room of the community'.

Use of the library for research and for finding information relating to the user's education and leisure interests, brings people into informal contact with other members of the community. This is because makerspaces in the library enable mentor-led learning between students, teachers, and other members of the school community. More so, using the public library can be a positive social experience. Public libraries maintained their specific roles irrespective of any development in the system. Therefore, it cannot set back from their established roles i.e. culture, education, reading, literacy, and information. The most widely accepted definition of a public library was formulated by UNESCO in 1949 which was later revised in 1972 (UNESCO 2004). According to UNESCO manifesto, the definition of a public library is as follows:

a. Public Library is financed for the most part out of public funds.
b. It charges no fees from users and yet is open for full use by the public.
c. It is intended as an auxiliary educational institution providing a means of self education which is endless.
d. It houses educative and informative materials giving reliable information freely and without partiality.

The functions of public library is in consonance with library makerspaces. The function as highlighted by Handa (2015) are as follows:

1. **Access to Tools of information and Education-** It is the primary function of a public library to select and to organize need-based literature and other means of information and education suitable to the requirements of the local community in which the library is located.
2. **Instrumental in Informal Self-Education-**Public library is one of the agencies on which an adult heavily relies. It proves him/her suitable learning material to develop his/her skill and competence in areas of interests. Self education may be obtained through a public library such as methods of agricultural operations, scientific methods of poultry, bee keeping etc.
3. **To Promote Cultural and Social Activities-** A public library lends active support to many socio-cultural groups, such as children's club, youth forum, dramatic club, teachers

association, lawyers or doctors associations, film society etc. to conduct their activities through its premises or through its rich informative, educative and cultural materials.

4. **Preservation of Local Material-** Another important function fulfilled by a modern public library is to identify and collect cultural material of importance available in its jurisdiction. These may be works of art or sculpture, paintings, documents, musical instruments etc. In a nutshell, a public library goes in search of all such materials which link the people of the locality with its cultural past.
5. **Strengthening of Democratic Spirit-** By bringing together in its socio-cultural activities seemingly different segments of the society on a single platform, the library slowly develops a sense of amity, a sense of respect for other groups, an appreciation of the differences in languages, religion, customs and manners. Thus sectarian life styles are substituted by democratic life patterns. In this sense, a public library justifies its existence as a democratic institution.

The rapid growth in the volume of available information and the continuing technological changes, which have radically affected the way information is accessed, have already made a significant effect on public libraries and their services. Information is very important to the development of the individual and of society, and information technology gives considerable power to those able to access and use it. Despite its rapid growth it is not available to the majority of the world's population, and the gap between the information rich and the information poor continues to widen. A vital role for the public library is to bridge that gap by providing public access to the Internet as well as providing information in traditional formats. Public libraries should recognize and exploit the opportunities provided by the exciting developments in information and communications technology. They have the opportunity to become the electronic gateway to the information world (München, 2001). München (2001) therefore suggested that librarians should be imaginative in seeking external sources of funding for the public library. However, they should not accept funding from any source if, by so doing, the fundamental status of a public library as an agency available to all is compromised. Commercial organizations, for example, may offer funding with conditions which might prejudice the universal nature of the services provided by the public library.

Disadvantages of Library Makerspace

Low level of investment and low funding of the library that inhibit a befitting structure could be a barrier for makerspaces in the academic and public library. For some libraries, initial investments required to set up a makerspace can prove a barrier to implementation (Greenwalt, 2013). More so, some items commonly used in these spaces can be dangerous if not used properly. However, many makerspaces aren't necessarily technology focused, and can be low-cost, reducing some of these risks. As s new phenomenon, this has created a unique set of challenges for participants, who are often trying things for the very first time. Participants found it a particular challenge to translate the value and relevance of new and different programs and technologies to those who are used to a more traditional library model (Slatter & Howard, 2013). Another possible challenge was budgetary constraints. While some funds were relatively simple for participants to procure, the changing nature of the technology and high cost of importing these items sometimes proved challenging.

According to Mississippi Department of Education (n.d), budgets can be one of the most difficult aspects of being a librarian or to own a library. Nevertheless, a makerspace does not need much of a budget to operate. Tools and supplies can be donated or borrowed and many projects can be self-funded with community and parental involvement. However, there is always a new gadget or piece of technology to purchase and try. Develop a baseline budget and what type of Makerspace to offer before purchasing. If there is a gap in funding there are numerous options for receiving grants or donations to fill the void.

Conclusion

Makerspace in Libraries is a collaborative efforts put into place by professional librarians in the academic and public library to achieve the mission and vision the library. This is to further improve teaching, learning and research. More so, makerspace gives the armputs opportunity to the library users to be creative. Library user of this 21st century are not just to sit quietly and consult books and other pedagogical materials but they have completely transformed into a spot where users can interact, create and collaborate. Makerspaces are the demand of modern libraries and expected to be a growing trend in the years to come. The idea of establishing makerspace in the library fosters creativity and invention. Makerspace in the library meet the unexpressed needs of library users, influence them to patronize and profitably engaged in the library, woo library users to the library to remain relevant in the technological world. However, significant

challenges were also identified to their successful implementation. In particular, budgetary constraints, resistance to change within organisations, lack of technical skills, inadequate power supply and lack of trained manpower.

The study framework can be used as a tool by library management, educators and facilitators to be more purposive about the Makerspaces they are initiating or working at. The framework is a reflection of the similar function performed by the academic and public library. This proposed framework could be a much-needed contribution to the gap in knowledge that exists in current Maker education literature. Work in this paper conceptualizes Makerspaces and provides considerations to realize their purported educational potential. The terms used in the framework are flexible, and the framework can be modified as the phenomenon of Makerspaces evolves and helps understand the phenomenon rather than predicting it. All three of these characteristics, flexibility, capacity for modification, and understanding are advantages of a good conceptual framework (Jabareen, 2009).

Recommendation

Based on the findings, the following recommendations were made:

(a) Academic and Public library should carry out awareness in the library for users concerning makerspace creation in the library.

(b) Library should be a place that should allow more practical work by the students rather than been theoretical alone.

(c) The academic and public library should provide funds for the library to create an environment promoting student skills by introduce new technologies and boost the library's image

(d) The academic and public library should make models of successful makerspaces.

(e) The academic and public library should organize workshop and training programs for the librarian to effectively manage inclusive makerspaces in the library.

(f) Users should carefully and properly handled the technologies made available in the space provided.

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