Makerspaces:
The Next Generation Library Tool for Capacity Building in Developing Countries

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ABSTRACT

The idea of makerspace in a library is one that has re-emphasized the importance of library spaces in today's digitally controlled society. Makerspace as a concept promote creative learning, critical thinking, communication, collaboration, and problem-solving skills among people and also inspires them to shift from being passive consumers to active creators. The library makerspace provides space for people of all ages to build prototypes, explore new ideas, and build something together, thus enhancing human capacity building among library users. Consequently, this paper theoretically examined makerspace as a library tool for capacity building in developing countries. The concept of makerspace, makerspace tools, and the best practices for effective makerspace were discussed. The paper also explored makerspace as a library tool for capacity building as well as the challenges faced in creating library makerspaces. The paper concluded that library makerspaces provide a safe place for people to feel comfortable creating and using powerful tools without feeling pressured.

KEYWORDS

Capacity Building, Developing Countries, Do It Yourself, Fablab, Hackerspace, Library Makerspace, Library Tool, Makerspace, Next Generation Library

INTRODUCTION

Library space has in time past, been a place for learning and silence. Individual learning was practically the norm in libraries prior to the 21st century as every library user is entitled to their space. However, in the last two decades, there has been a change in the way library spaces are been used. Okuonghae (2019) noted that libraries of today are no more seen as a place of individual learning, but also, a place for collaborative learning. Velasquez (2018) explained that library spaces are now used as creative spaces to promote creativity among library users. The libraries can promote experimentation, collaboration, and creativity among individual library users by organizing creative programs. To promote creative learning in this era of technological advancement, libraries in developed countries have widely adopted the idea of makerspaces in libraries. This is in an attempt to make the library more inviting to the library users while also enhancing transformative, innovative, creative, and collaborative learning mostly among teens and youth. This, therefore, emphasizes the need to create makerspaces in libraries in developing countries, as such spaces have the potential of birthing ideas and innovation that could foster development in the country.

The genesis of makerspace can be traced back to the launch of the Make: magazine in 2005 which gave impetus to the maker movement. In 2014, Burke opined that the MIT Fab Labs, which were conceived to create an object from ideas, provided the platform for people to try to make different "things" and be innovative. This subsequently significantly influenced the widespread adoption of makerspace as a tool to promote collaborative learning and creativity among people. Today, schools, libraries, and information centers have widely adopted makerspace ideologies to promote learning. Therefore, this study is set out to review relevant literature on makerspace as a potent tool for capacity building in Nigeria. The study consequently adopted the literature review method to discuss the concept of makerspace and set the ball rolling for its widespread adoption in Nigerian libraries. The study gave a conceptualized definition of the concept of Makerspace, identified and discussed the makerspace tools and technologies used, and explained the concept of capacity building. In addition, the study examined makerspaces as a library tool for capacity building as well as best practices for an effective library makerspace. Finally, the challenges facing makerspace adoption in libraries were discussed with possible recommendations.

MAKERSPACE: A CONCEPTUAL EXPLANATION

Over the years, different scholars have attempted to give a different definition of the term Makerspace. Makerspace sometimes referred to as hacklab, hackspace, or hackerspace is "considered a place where informal, collaborative learning and discovery take place through hands on creation, via the use of any combination of art and technology" (Velasquez, 2018). Okuonghae (2019) defined "makerspace as a collaborative workspace inside a school, library, or separate public/private facility for making, learning, exploring, and sharing knowledge that uses high-tech or no-tech tools". Laura Flemming worlds of making (n.d) explained that "to define a school makerspace by its purpose and simplest of terms, it is a place where young people have an opportunity to explore their interests; learn to use tools and materials, both physical and virtual; and develop creative projects". Therefore, a makerspace is a creative space equipped with tools and equipment needed to design, build and create something with the view of learning a new skill and encouraging teamwork.

Furthermore, it is important to note that makerspaces enhance the creation of things using technological (high tech) and non-technological tools (low/no-tech). Through makerspaces, institutions such as libraries and schools can render 21st-century training, which will equip students and library users alike, with new forms of literacy that are needed to effectively explore various types of technology. In addition, makerspace promotes critical thinking, problem-solving and collaborative skills among individuals. Creative works that can be promoted by makerspace include 3D printing and scanning services, laser cutting and design-jet plotting, virtual reality, LittleBits, craft making, and digital production. Consequently, the equipment commonly found in makerspaces includes 3D printers, laser cutter, sewing machines, cardboard papers, computer hardware, and software amongst others. Examples of libraries in developing countries with makerspace programs include the University of Pretoria Library Makerspace and the American Embassy Library Space in Abuja, whereas other libraries in developed countries also have advanced makerspace centers. Examples of such libraries include Carnegie Mellon University's Hunt Library, Chicago Public Library, Johnson County Library, DeLaMare Library and North Carolina State University Library, all in the United States of America.

MAKERSPACE TOOLS AND TECHNOLOGY

Makerspace fosters learning, creativity and promotes the Do-It-Yourself (DIY) culture among children, teens, and adults. This makes it a very welcome idea in developing climes where creativity, innovation, and independent learning are greatly desired. Wang, Wang, Wilson, and Ahmed (2016) opined that the "maker culture embraces the experimentation, invention, prototyping, and investigation of theory through self-directed practical work". Makerspace also promotes knowledge sharing, collaboration

and support, creative thinking, playful learning, social interaction, and informal mentoring. However, to have an effective makerspace, certain tools must be made available depending on the nature of the makerspace program a library intends to establish. It is important to note that makerspace may be low tech or high tech (Okuonghae, 2019). Since makerspace comes in different shapes, themes, and levels of sophistication, the tools/technologies needed may vary from one makerspace center to another. For most high-tech makerspace, the tools usually found include 3D printers, 3D scanners, laser cutters, and computer hardware and software for coding and programming. Other tools could include electronics such as Arduino, Raspberry Pi, Makey Makey, Little Bits, and Lego Kits (Red Deer College Library, 2019). These tools make it possible for individuals to create technological inventions and learn about different ways to achieve a result.

Also, for most low tech makerspace, the tools usually found include a sewing machine, soldering equipment, arts and crafts supplies such as button and circuit, plastic materials, cardboard, knitting and crochet supplies, Styrofoam, paint, rainbow loom, tinker toys, attribute blocks, box rivets (makedo and/or mr. mcgroovy), k'nex, and plastimake (Rosheim, 2018). Other non-technological tools that could exist in a makerspace include paper cutouts, beads, clay, duct tape, gears, and fabric. According to Lynch (2017), the tools needed to begin a less expensive makerspace include:

1. Paper and other Art Essentials: Different kinds of paper can be used in a makerspace depending on the type of makerspace. Cardboard, cardstock, paper towels, printer paper, newspapers are different papers that could be used in a makerspace. These papers could be used to create different things such as gift tags of book pages, cardboard tube construction toys, greeting cards, and others.
2. Digital tools: These tools are electronic and include 3D printers, laser cutters, vinyl cutters, and 3D scanners. These tools are used to create technological innovations such as computer programs and codes, 3D designs for different sectors, web designs, electronic kits, and open-source designs.
3. Circuit: This kind of tool gives room for endless possibilities of creation with a focus on electricity and machinery. With tools such as a snap circuit, students can create their own devices.
4. Coding and Programming Tools: Students can learn coding and programming in makerspaces by working with materials such as computer hardware and software (App) as well as with the use of mock computers which could be used for elementary learning of coding with bracelets, blocks, and hand-drawn mazes.
5. Books: Books are essential instructional that can serve as a guide to creating an effective makerspace in the library. The kind of books to be used in a makerspace depends on the kind of makerspace. Books like 'The Ultimate Workshop and Tool Guide' and Makerspace Playbook: Schools Edition are good books, to begin with.
6. Brushbot Supplies: Scrub brushes and electric toothbrushes
7. Old car toys: Rocket-propelled balloons, old car toys with gears or switches, electronic motors for scribble bots, wire cutters, wire from phone lines, alligator chips, and old electronics

Capacity Building: What Does It Mean?

Capacity building is an essential ingredient for transformation and development in any country. In 2009, the United Nations defined capacity building as the "process of developing and strengthening the skills, instincts, abilities, processes, and resources that organizations and communities need to survive, adapt, and thrive in a fast-changing world". Anand (2018) explained that capacity building any conscious and deliberate effort, endeavor, facility, and opportunity provided to the employees of an organization, establishment, and outfit irrespective of their status to improve their skills, attitude, behavior, experience, ideas, knowledge, education and information acquisition with the view to enhance their performance and productivity for ensuring optimal success in achieving the overall

objectives, goals, mission, and aspirations of both the employer and the employee. It can sometimes be referred to as human resource development or manpower development.

Capacity building involves training individuals with the needed competency and understanding, to undertake their duties effectively and efficiently (Claussen, 2011). Sometimes, capacity building and capacity development are used interchangeably. The essence of capacity building is to develop the knowledge and skills of an individual to improve his/her productivity. The capacity building could be in form of a one-off intensive training course, facilitated workshop or exercise, Modular training course, or internship.

Makerspace as a Library Tool for Capacity Building

Libraries, as knowledge centers, have adopted different technologies/methods in recent times to meet the ever-increasing needs of library users. Libraries of today are known to be promoters of learning, research, and innovation (Okuonghae, 2019). The widespread advancement in the fields of science, technology, engineering, and maths (STEM) has created a knowledge gap that requires practical collaborative creative learning to fill. As a catalyst of change, libraries have begun to adopt different ways to transform learning. One of such ways is by creating a library makerspace. Through makerspace, libraries can promote critical thinking, creativity, and innovation (Okpala, 2016).

Despite being a relatively new practice, the creation of makerspace in a library ensures library users get hands-on experience with concepts they recently learned. The point of the space is to make, create, and invent new things. Makerspace as a library tool ensures that the libraries accommodate all kinds of learners and engage the mind of the users. Thus, Lynch (2017) identified areas in which library makerspace develops/ builds human capacity. Aside from enhancing the thinking ability of people involved in makerspace, people can cultivate problem-solving skills which will be useful in dealing with life problems. Kalu and Chnyere (2019) observed that makerspace is an emerging learning space in academic libraries in Africa and academic libraries must come up with policy initiatives and strategies for the adoption and domestication of maker spaces. Also, makerspace encourages users to be innovative while helping them to build their perseverance. Furthermore, with makerspace, students can make the connection between lessons and the real-world scenario, in addition to providing a memorable lesson that improves their understanding.

In recent times, libraries in African have contributed significantly to human capacity building especially in the area of ICT skills and information literacy skills development of library users. Through user instruction or library education programs, libraries can train users on how to use the different information resources in different formats. Similarly, the introduction of makerspace in libraries is helping to shape kids (library users) for future jobs. Banner (2019) observed that makerspaces are currently changing the way students learn (from passive to active learning). Students learn how to think entrepreneurially and develop skills that are going to be invaluable in the nearby future. The library makerspace allows learners of different kinds to express themselves, fail and try again. Essentially, Makerspaces engages learners in creative and problem-solving activities (New Media Consumption, 2015). According to the NMC (2015), makerspaces have the potential to effectively address the necessary skillsets for students in the 21st Century. By creating a library makerspace, students of varying abilities learn and develop new skills such as:

1. Critical thinking and problem solving: The library makerspace builds the critical thinking and problem-solving skills of users/participants. In a makerspace setting, participants are given a challenge that will usually require critical thinking for it to be solved. It also encourages young people to find solutions to problems or learn to solve problems (individually or collaboratively) through critical thinking.
2. Communication: communication is an important skill that everyone should build or develop because it is fundamental to the existence and survival of humans and organizations. Library

makerspace helps build participants' communication skills as they are required to share ideas and information as well as explain solutions to problems from time to time.

3. Collaboration: through collaboration, individuals or a group of people work together to achieve a common goal by sharing their ideas and skills. Makerspace activities promote collaboration and teamwork among youths and children in order to solve technical problems.

More so, the library makerspace aids the overall skills and efficiency of library users and it has become a place for mentoring. Ayeni (2018) identified six ways in which makerspace aids the development of library users. They include:

1. It enhances self-directed learning amongst students, thus, students are encouraged to work on areas that are of interest to them.
2. It encourages creativity and innovativeness in solving critical problems.
3. It provides a safe and comfortable space for learning and birthing new ideas.
4. Learners can test hypotheses and try again if they fail.
5. makerspaces enhances students ability to focus on an idea or a problem
6. Makerspace provides the right avenue for collaborative learning and knowledge sharing among participants.

Furthermore, Anand (2018) opined that makerspace programs in libraries give room for participants to possess hands-on skills such as being 3D designers, Roboticists, creative artists, programmers, web and App developers, fashion designers, game and software developers, digital fabricator, hardware engineers, and painter. In addition, library makerspace gives room for people (men and women) to feel equally comfortable knitting, coding, drawing, or using power tools without feeling pressure to prove they belong there.

Best Practices for Effective Makerspace

Creating effective makerspaces in the library demands that the library staff follow the best practices for effective makerspace. According to Ebsco Post (2019), the best practices to ensure one's makerspace contributes to a successful learning experience for all include:

1. Provide visual cues. "An effective strategy to ensure that your makerspace helps to meet all of your learners' needs is using visual cues to communicate and give necessary directions. Effective visual cues will support your learners in becoming independent thinkers and problem solvers."
2. Furniture should be of a different variety — "offer different heights, armrests, and surfaces to support a diverse user base."
3. Keep tools in a visible location
4. Use tables having wheels to enable easy re-arrangement of spaces.
5. Sharp objects should be kept neatly with warnings to prevent an accident.
6. Provide as many tools as possible. "Each student with special needs has varying abilities, so it's important to match tasks to cognitive and physical skills."
7. Quiet spaces should be included in the makerspace.

CREATING MAKERSPACE IN LIBRARY: ANY CHALLENGE?

The creation of a makerspace in the library just like any innovation comes with a different degree of challenge. First, the librarians will need to address the issue of space in the library. for there to be an effective library makerspace program, librarians must create a conducive physical space for creativity to occur in the library. The issue of space in the library, usually, is of great concern to many

libraries and librarians in Nigeria as many libraries in the country do not have adequate space in the library (Ugwuanyi, Okwor, and Ezeji, 2011). This is quite worrisome especially since the library space is one of the most valuable assets of a library (Okpala, 2016) where learning, teaching, and research take place.

Also, another challenge facing the creation of makerspace in libraries is the issue of cost. The cost here refers to the cost of setting up the makerspace, paying facilitators as well as acquiring and maintaining the makerspace materials such as computers, soldering iron, 3D printers, 3D scanner, computer software, soldering benches, furniture, sewing machines, markers, and scissors. Even though the creation of a makerspace in the library will make the library more attractive, it will no doubt affect the already declining budget of the library. As noted by Slatter and Howard (2013), the constraint in the library budget makes it a difficult task to acquire expensive makerspace tools in the library. In addition, Greenwalt (2013) opined that the initial investment needed to set up a makerspace may prove to be a barrier to its implementation due to reduced funding and an uncertain library budget.

Furthermore, Curiosity commons (2019) identified "staffing and scheduling, staff and patron training, neatness and noise maintenance, safety and liability, resistance to change, copyright, and intellectual property" as challenges associated with the creation of makerspaces in libraries. In a study conducted by Slatter and Howard (2013), staff resistance to change is a major constraint to the successful implementation of makerspace in the library. They opined that staffs are usually reluctant to see a change in their library and this negatively affects the implementation of new innovations such as makerspace in the library. in addition, Okpala (2016) and Okuonghae (2019) explained that the challenges facing libraries in establishing makerspaces include lack of interest by library staff or library staff resistance to change, erratic power supply, low user patronage of the library, space issue, lack of adequate skilled staff and high rate of technological anxiety among library staff and users.

According to ACRLog (2016), the common challenge encountered when setting up library makerspace includes:

1. **Space Issues**

    The issue of space is usually a thing of concern in many libraries in Africa. To have an effective makerspace, the right space (and location) must be created in the library. However, many libraries are already facing the issue of inadequate space, thus posing a great challenge for libraries' interests in setting up a makerspace.

2. **Creating a Makerspace Theme or Lack Thereof**

    It is expected that every makerspace should have a theme. The theme could be related to art-based or could involve any or all of the STEM disciplines such as Science, Technology, Engineering, and Mathematics. Although, it should be noted that the ultimate flavor or theme of every makerspace is dependent on the instructor in charge and the users of the makerspace.

3. **Equipment and Budget**

    Another challenge faced when setting up makerspace is the issue of identifying equipment to purchase and budgeting. When budgeting and identifying equipment to be purchased, it is always advisable to always put the need of the patrons ahead of other needs. Thus, the only equipment needed for a particular makerspace could be purchased while others are kept until there is enough funds. As such, the budgeting and the equipment to be purchased should be dependent on the kind of program to be offered in the makerspace.

3. **Developing Curriculum**

Curriculum development is crucial to having an effective makerspace. The success of a library makerspace is highly dependent on the development of a good curriculum. However, developing a makerspace curriculum can be a difficult task especially when the librarians have little or no experience with makerspace.

CONCLUSION

It is becoming increasingly difficult to avoid the talk of makerspace in libraries due to the numerous benefits it brings to both the library and the library users. Library maker-focused programs do not only promote critical thinking and problem-solving skills among library users but also inspire and empower library users to make, create and learn new skills such as programming, coding, 3D designing, game/App/Software developing, painting, knitting, drawing amongst others. Aside from learning new skills, library makerspace teaches library users the value of teamwork (collaboration), leadership, and mentoring, as well as communication and interpersonal skills, thus, enhancing the overall capacity building of the library user. These skills, if put to good use, will enhance the actualization of the United Nations Sustainable development goals in developing countries like Nigeria where production and creativity are very low. By embracing the idea of makerspace, libraries will be able to make a significant impact on society. It is therefore expedient for library management to think along the line of Makerspace adoption.

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