Extent of Use of Maker-spaces in Library as Innovative Tool for Harnessing Creativity in School Libraries in Rivers State, Nigeria.

by

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ABSTRACT

This study investigated the extent of use of maker-spaces in library as innovative tools for harnessing creativity, learning and innovation in Rivers State's private secondary schools. The research had three main objectives, three research questions and hypotheses were formulated to guide the study. The study adopted descriptive survey design. The population of the study consists of 1,365 with a sample size of 309. A structured questionnaire was used to collect data for the survey. The hypothesis was tested using the Pearson Product Moment Correlation coefficient (PPMC) at 0.05 level of significance. In contrast, the study's themes were analyzed using fundamental descriptive statistical tools including means and standard deviations. The findings show among others that there was a strong positive relationship between maker-spaces and innovation within the student body of Rivers State's private secondary schools (P =.000, p<0.05), additionally, there is a strong correlation between these students' inventiveness and maker-spaces. (P =.001, p<0.05). The study among others recommended that school administrators should consider investing in maker-spaces, including in the school library, as it serves as the institution's intellectual cornerstone.

Keywords: Maker-spaces, library, creativity, connectivity, innovation, secondary schools, school libraries, Nigeria

Introduction

Over time, the functions of school libraries have changed to encompass not only a space for reading and studying, but also an area for socializing, engaging in crafts, storytelling, and playing games. As civilization has progressed, the twenty-first-century school library has expanded to address the holistic growth of students. By supporting students' academic success (Staff, 2021; and Little, 2022), promoting the development of 21st-century abilities and guaranteeing fair access to the material and intellectual resources and instruments required for learning in an engaging and cozy setting (Martinez & Stager, 2013). Also by nurturing their motivation, progress, independence, and interaction, school libraries have transformed into essential learning resource centers (Kammer, King, Donahay & Koeberl, 2021). School libraries are crucial components of educational systems in enhancing students' cognitive abilities.

Makerspaces, according to Feinstein, DeCillis, and Harris (2016), are settings where people can develop and create in a maker community. According to their definition, makerspaces are innovative spaces dedicated to skill development, aligning with the primary objective of twenty-first-century education. This supports Oyewole (2017) assertion that the educational system is transitioning from content-based education, which emphasizes students' knowledge acquisition, to outcome-based education, which focuses on students' abilities and understandings.

By fostering connections between students and their "inner self," mentors or trainers, other makers, and the community at large, makerspaces not only promote creativity but also aid in the development of students' affective skills. Additionally, students must develop their cognitive faculties to acquire experiential knowledge, analytical thinking, and critical thinking (Omorodion, 2019). Therefore, it is evident that school libraries can utilize makerspaces to harness students' creativity for learning and collaboration. However, the effectiveness of this process heavily relies on the roles played by relevant parties in ensuring its success.

The availability and the number of makerspaces in public, academic, and school libraries is growing. Burke (2015) posits that makerspaces are typified by the shared tools and materials that users in collaborative workspaces utilize to produce both digital and tangible things. These sections are created by librarians at libraries to promote cooperation and the sharing of ideas among users with varying specializations. According to Turner, Welch and Reynolds (2013), a makerspace is also a location where new items are outfitted and manufactured. Students can improve

their learning and conduct experiments outside of the usual classroom setting by using makerspaces (Burke, 2015).

Large size printing, audio and visual capture, painting courses, and music recording places are just a few of the creative spaces and activities that librarians are enhancing using cutting edge technology. The implementation of internet networks in library buildings has inspired some library employees to create extensive maker space initiatives for users (Burke, 2015). Similarly, Colegrove (2013) contended that by physically increasing their offerings, libraries both support and gain from the effect of makerspaces. This promotes in-person library visits in addition to assisting libraries in serving as dynamic, appealing information hubs (Al-Mousawi, 2018).

Academic libraries should also concentrate on creating shared workspaces where community members can collaborate and share resources (Adejo & Babatude, 2021). Recording the creation and application of maker space procedures in university libraries is crucial. In order to promote creativity in the libraries of Rivers State private secondary schools, this study aimed to look into the idea of makerspaces.

Statement of the Problem

When a makerspace is added to the school library, students' perspectives could change to emphasize creativity. But it appears that the idea of makerspaces has not yet caught on in Nigerian school libraries. This is probably because there aren't many makerspaces in school libraries, particularly in Nigeria's state-own primary and secondary institutions. It was observed by the researchers that lack of awareness of the function of maker-spaces plays in supporting students' creative development and the expectations of pertinent parties in this context may be the cause of this lack of adoption. Thus the aim of this research is to examine the extent of use of maker-spaces in private secondary school libraries in Rivers State**.**

Objectives of the Study

The main purpose of the study is to examine the extent of use of maker-space in private secondary schools in Rivers State. The specific objectives of the study are:
 1. To find out the extent maker-spaces increased pupils' creativity in Rivers
    State's private secondary schools.
 2. To determine the extent maker-spaces facilitate connectivity and learning among students in private secondary schools in Rivers State.

3. To investigate the extent maker-spaces promote innovation among students in private secondary schools in Rivers State.

Research Questions

The following research questions guided the study:

1. To what extent do maker-spaces enhance creativity among students at private secondary schools in Rivers State?
2. To what extent do maker-spaces facilitate connectivity and learning among students at private secondary schools in Rivers State?
3. To what extent do maker-spaces enhance innovation among students at
   private secondary schools in Rivers State?

Hypotheses

The following null hypotheses were formulated to guide the study:

Ho_1:   There is no significant relationship between maker spaces and creativity among students at private secondary schools in Rivers State

Ho_2:   There is no significant relationship between maker-spaces and connectivity and learning among students at private secondary schools in Rivers State

Ho_3:   There is no significant relationship between maker-spaces and innovation among students at private secondary schools in Rivers State.

Literature Review

Children have utilized school libraries as educational environments to enhance their cognitive growth in diverse areas such as applied arts, quantitative and qualitative analysis, and logical reasoning. Nevertheless, the fundamental justification for maker-spaces, as argued by Honey and Kanter (2013), is imperative for transforming school libraries by fostering children's emotional growth and engagement with their peers and the community.

Makerspaces are the ideal environment for both creating and accessing the necessary tools. Consequently, tools are integral components of makerspaces and can range from basic to highly advanced, particularly in the context of student makerspaces. Makerspaces, particularly those in school libraries, often have a wide range of supplies and equipment available, like letter stickers, pipe cleaners, string, ribbon, crayons, sticky notes, elastics, magnets, pins, colored plastic, model magic, cardboard, wood, plastic, Styrofoam, Fischer Technik, LEGO, K'NEX, soldering

irons, 3D printing, milling machines, and laser cutters (Sheridan, Halverson, Litts, Brahms, Jacobs-Priebe & Owens, 2014).

Ebigbagha (2021) states that creativity entails "the development of new ideas or the recombination of known elements into something new, delivering valuable solutions to a problem." This definition underscores the close relationship between creativity and innovation, as creative ideas form the basis for innovation (Cachia, Ferrari, Ala-Mutka & Punie, 2010). Runco and Jaeger (2012) proposed that creative abilities are the defining characteristics of creative individuals, determining their capacity for exhibiting creative behaviour. Depending on their temperamental and motivational characteristics, these skills may or may not result in truly creative output (Runco & Jaeger, 2012).

The act of making has always been an integral part of civilization, serving as a tool for advancement. Stager (2017) stated that making fosters a positive outlook on the world and provides the competence and confidence needed to address difficulties. Makers typically possess an optimistic outlook and a "I-can-do-it" mentality, forming an experimentation habit that fosters curiosity, discovery, and teamwork, as noted by Makermedia (2013). Successful experiments lead to invention or making, and makerspaces offer the opportunity for such endeavors.

Feinstein, DeCillis, and Harris (2016) highlighted that makerspaces foster connections between individuals from different fields and encourage creativity, critical thinking, cooperation, and communication. As such, makerspaces serve as the creative engine room, essential for long-term development. Given that students are the primary focus of the makerspace movement, structured making in makerspaces is crucial for fostering creativity in them. While schools aim to promote cognitive growth, makerspaces enable students to cultivate ideas and engage in the process of manufacturing and testing those ideas to produce a final product (Brahms & Crowley, 2015).

Students may engage with one another and gain useful skills in a makerspace environment, especially in the areas of math, science, and technology. Makerspaces, according to Soomro, Casakin and Nanjappan (2023) were developed to encourage the exchange of tools, supplies, information, and concepts, enabling students to interact with people who have similar interests in the creative process. In makerspaces, students collaborate to share resources like information and tools, creating a cooperative atmosphere. As a result, a growing number of academic institutions are worried about creating makerspaces in their school libraries, especially in the West (Weisgrau, 2015).

Additionally, as Hamilton (2012) points out, makerspaces support interactive learning by encouraging student collaboration on projects and experience-based learning This is in accordance with the Broadband Commission's emphasis on the need for comprehensive school connectivity plans and the importance of digital transformation in education (Broadband Commission, 2020). Some of these concepts include configured expertise, learning connected to students' identities and interests, opportunities for producing with a range of media, tools, and practices, and an integrated learning system that facilitates links between the home, school, community, and wider world. They also encompass heightened drive and engagement through purposeful play and experimentation.

Makerspaces are unique, which is why a range of projects employ them. Using themes including 3-D printing, electronics/audio, inventing, laser cutting, coding, soldering, learning circuits, robotics and electricity using paper circuits, sewing, woodworking, and hands-on workshops, Okuonghae (2019) provides examples of these projects. As a result, academic libraries are encouraged to develop initiatives that support patrons in learning, creating, exchanging, and do-it-yourself (DIY) knowledge through makerspace programs. These initiatives may include in-house seminars, workshops, and learning commons. Access to this information not only enhances students' critical thinking skills but also fosters creativity. In addition to providing space, the library offers users the opportunity to utilize, produce, and share materials and data, thus enabling the community to exchange methods, data, or the necessary tools for creation at the library (Okuonghae, 2019).

According to Abram (2013), makerspaces should address several needs, including providing access to a wide range of technologies and tools that facilitate knowledge sharing, resource sharing, and group interaction, supporting individual projects by offering access to physical space, fostering a transparent environment that encourages creativity and innovation, and providing access to tools used in businesses for professional projects.

Makerspaces are environments where individuals can experiment and develop new ideas and products while interacting with others, serving as platforms for learners to express their creativity. Therefore, a maker requires a supportive environment that facilitates the flow and realization of ideas to be authentic and creative. Establishing makerspaces in libraries goes beyond simply combining idle space with an ideal environment; it

involves engaging library users to select dynamic facilitators to coordinate the activities (Okuonghae, 2019). To create makerspaces in libraries, the following specifications are expected to be met, as outlined in the Makerspace policy (Okpala, 2016).

The ideal space for the makerspace should be located away from the component being added, with separate doors, windows, and equipment designated for the makerspace area. It is important to allocate security guards and library porters to ensure protection and have a central operating area. Additionally, strategically placing the makerspace next to the Open Public Access Catalogue (OPAC) will help promote user interest and participation. According to Scalfani and Sahib (2013), open access to visible experiments and independent authorization for 3D users are crucial for the success of 3D studios.

The theme or program for the makerspace should focus on innovation and creativity, targeting users, especially enrolled instructors and students. Funding for the makerspace should primarily come from the library's annual budget, with potential involvement from international and local investors. Furthermore, program training and assistance should be obtained from mentors and experts, such as teachers, librarians, and teaching staff. Burke (2015) notes that library staff members are often responsible for instructing during workshops, classes, and training sessions, with additional instructors or experts including volunteers, outside instructors, IT staff, and members of maker groups.

Okpala (2016) notes that libraries serve as knowledge hubs where scholars can gather to investigate novel concepts and learn about cutting-edge resources and innovations. The establishment of makerspaces is justified by the large number of students who use the library for research. Participants have reported that the availability of resources, tools, equipment, and technologies, along with spaces, led to learning opportunities, increased community involvement, enabled information access, and drew a variety of patrons, all of which helped the library become a creative space and later provided evidence of its legitimacy (Slatter & Howard, 2013; Chan & Spodick, 2014). The makerspace movement has made libraries more regarded as centers of creativity that offer peaceful learning environments and a forum for the exchange of ideas, which has received additional support for the provision of a makerspace due to its significance, especially in the fields of knowledge creation and STEM education (Okpala, 2016).

Methodology

This study investigated the extent of use of maker-spaces in library as innovative tools for harnessing creativity, learning and innovation in Rivers State's private secondary schools. The study adopted descriptive research design. The population of the study consists of 1,365 drawn from students of five private secondary schools in Rivers State: Jephthah Comprehensive Secondary School, Graceland International School, Bereton Secondary School, Jesuit Memorial Secondary School, and Brainfield International Secondary School with a sample size of 309 using a Taro Yamane approach. A structured questionnaire titled (MLITHCQ) was used to collect data for the survey. The data collected were analysed using Statistical Package for Social Sciences (SPSS) version 23.0, employing standard descriptive statistical methods such as mean and standard deviations.The hypothesis was tested at the 0.05 level of significance using the Pearson Product Moment Correlation coefficient (PPMC).

Research Questions

Research Question One: To what extent does makerspaces enhance creativity among students of private secondary schools in Rivers State?

Table 1: The Mean Responses of the Extent of Maker-Spaces Enhance Creativity Among Students

Cluster	A Response (N = 309)		S.D.	Decision
1	The utilization of makerspace in our school library helps to improve my creative ability	2.90	0.91	Agreed
2	The use of makerspace in our school library helps to enhance my imaginative ability	3.1	0.95	Accept
3	The utilization of makerspace in our school library has improved my artistic ability	2.84	1.08	Accept
Grand Total		2.95	0.96	Agreed

The **mean** responses regarding the extent to which maker-spaces enhanced creativity among students in private secondary schools in Rivers State are presented in Table 1. The collective average ($\overline{X}$= 2.95, S.D. = 0.96) derived from the responses surpassed the threshold of 2.5. Consequently, the participants agreed that the utilization of maker-spaces significantly enhanced students' creativity in private secondary schools in Rivers State.

Research Question Two: To what extent does maker-spaces facilitate connectivity and learning among students at private secondary schools in Rivers State?

Table 2: The Mean Responses on the Extent Maker-spaces Facilitate Connectivity and Learning Among Students

Cluster	Response	AR (N = 309)	S.D.	Decision
1	The utilization of maker-space in our school library has aided to improve my connectivity with other students	3.39	0.97	Agreed
2	The use of maker-space in our school library has helped to improve my learning ability	3.31	1.01	Accept
3	The utilization of maker-space in our school library has enhanced my ability t network with other students	2.85	1.08	Accept
Grand Total		3.18	1.02	Agreed

The mean responses regarding the extent maker-spaces facilitate students' connectivity and studying in private secondary schools in Rivers State are presented in Table 2. An overall average (mean = 3.18, S.D. = 1.02) was calculated from the responses, surpassing the threshold of 2.5. Consequently, the participants agreed that maker-spaces significantly improved student connectivity and learning in private secondary schools in Rivers State.

Research Question Three: To what extent does maker-spaces enhance innovation among students at private secondary schools in Rivers State?

Table 3: The Mean Responses on the Extent Maker-spaces Enhance Innovation Among Students

S/N	Cluster	Response AR (N = 309)	S.D.	Decision
1	The utilization of makerspace in our school library helps to improve my innovative ability	3.62	1.07	Agreed
2	The use of makerspace in our school library helps to enhance my capability to invent new things	3.31	1.03	Accept
3	The utilization of makerspace in our school library has improved my imaginative ability	2.89	1.04	Accept
Grand Total		3.27	1.03	Agreed

The mean responses regarding the extent to which makerspaces promoted innovation among students in private secondary schools in Rivers State are presented in Table 3. An overall average (mean = 3.27, S.D. = 1.03) was calculated from the responses, surpassing the threshold of 2.5. Consequently, the participants agreed that makerspaces significantly enhanced students' creativity in private secondary schools in Rivers State.

Test of Hypotheses

Hypothesis 1: There is no significant relationship between makerspaces and creativity among students of private secondary schools in Rivers State.

Table 4: Relationship Between Makerspaces and Creativity Among Students of Private Secondary Schools in Rivers State

Correlations		Makerspaces	Creativity	Decision
Makerspaces	Pearson Correlation	1	.832	Rejected
	Sig. (2-tailed)		.001	
	N	30	930	9
Creativity	Pearson Correlation	.832	1	
	Sig. (2-tailed)	.001		
	N	30	930	9

*S= Significant p<0.05

The results of an SPSS analysis illustrate the relationship between makerspaces and creativity among students in private secondary schools in Rivers State. The analysis revealed a strong positive correlation between makerspaces and creativity, as indicated by the Pearson correlation coefficient (r=.832), demonstrating a significant positive association between the two variables. Furthermore, the alternative hypothesis [(P =.001) p<0.05] was upheld, rejecting the null hypothesis, which posits that there is no meaningful relationship between makerspaces and creativity among students in private secondary schools in Rivers State.

Hypothesis 2: There is no significant relationship between makerspaces and connectivity and learning among students of private secondary schools in Rivers State

Table 5: Relationship Between Makerspaces and Connectivity and Learning Among Students of Private Secondary Schools in Rivers State

Correlations		Makerspaces	Connectivity And Learning	Decision
Makerspaces	Pearson Correlation	1	.920	Rejected
	Sig. (2-tailed)		.000	
	N	30	930	9
Connectivity And Learning	Pearson Correlation	.920	1	
	Sig. (2-tailed)	.000		
	N	30	930	9

*S= Significant p<0.05

The correlations between student learning, connections, and makerspaces in Rivers State's private secondary schools are demonstrated by the findings of an SPSS study. The data indicates a strong relationship

between makerspaces, connectivity, and student learning in Rivers State's private secondary schools. The Pearson correlation value (r=.920) between the variables shows a high positive association. Additionally, the alternative hypothesis [(P =.000) p<0.05] was supported, rejecting the null hypothesis, which maintains that there is no relevant association between student learning and makerspaces in private secondary schools in Rivers State and connectivity.

Hypothesis 3: Students in Rivers State's private secondary schools do not exhibit a discernible correlation between makerspaces and innovation.

Table 6: Relationship Between Makerspaces and Innovation Among Students of Private Secondary Schools in Rivers State

Correlations		Makerspaces	Innovation	Decision
Makerspaces	Pearson Correlation	1	.950	Rejected
	Sig. (2-tailed)		.000	
	N	202	202	
Innovation	Pearson Correlation	.950	1	
	Sig. (2-tailed)	.000		
	N	202	202	

*S= Significant p<0.05

The relationship between makerspaces and innovation among students in Rivers State's private secondary schools is demonstrated by the results of an SPSS analysis. The Pearson correlation coefficient (r=.820) indicates a substantial positive association between the two variables, supporting the analysis's extremely robust positive correlation between makerspaces and innovation. Additionally, the null hypothesis—which contends that there is no significant correlation between makerspaces and creativity among students in Rivers State's private secondary schools—was rejected by the alternative hypothesis [(P =.000) p<0.05].

Discussion of Findings

The participants in research question 1 agreed that the utilization of maker-spaces significantly enhanced students' creativity in private secondary schools in Rivers State. In fact, students at Rivers State's private secondary schools showed a noticeable increase in their level of inventiveness. Rejecting the hypothesis that there is no significant link between maker-spaces and creativity among students in Rivers State's private secondary schools, the alternative hypothesis [(P =.001) p<0.05] was supported. This finding validates the hypothesis put forth by Olawale and Magnus (2017), who postulated that the implementation of makerspace projects successfully will influence stakeholders' capacity to

support schoolchildren's creativity, consequently impacting the children's learning and sense of community.

An overall average (mean = 3.18, SD = 1.02) was calculated from the responses in research question 2 surpassing the threshold of 2.5. Consequently, the participants agreed that maker-spaces significantly improved student connectivity and learning in private secondary schools in Rivers State while the hypothetical use of makerspaces in private secondary schools in Rivers State has greatly enhanced student connections and learning. Furthermore, the claim that there is no significant correlation between student connections or learning at Rivers State's private secondary schools and makerspaces is unsupported by any data. A separate hypothesis [(P =.000) p<0.05] was confirmed. This aligns with a study by Omorodion (2019) that shows how makerspaces support the development of interpersonal communication, teamwork, leadership, and mentoring abilities in addition to critical thinking capabilities.

An overall average (mean = 3.27, S.D. = 1.03) was calculated from the responses in research question 3, surpassing the threshold of 2.5. Consequently, the participants agreed that maker-spaces significantly enhanced students' creativity in private secondary schools in Rivers State. Also, Students' inventiveness was significantly increased by maker-spaces in Rivers State's private secondary schools. The hypothesis that there is no significant association between innovation and maker-spaces among students in private secondary schools in Rivers State was disproved by the alternative hypothesis, which was supported [(P =.000) p<0.05]. This outcome is consistent with the suggestion put up by Adejo and Babatude (2021) that, in order to facilitate research and academic endeavours, library directors in their individual institutional libraries should create maker-spaces as soon as feasible.

Conclusion

The results of the study demonstrated that when students used the makerspaces in the library, they dramatically boosted their creativity, learning connection, and innovation in Rivers State's private secondary schools. Consequently, makerspaces in libraries, as cutting-edge resources, significantly increased the creativity of students in Rivers State's private secondary schools. Additional research indicated that among students in Rivers State's private secondary schools, makerspaces were strongly positively connected with learning, creativity, and connectivity, and significantly favourably correlated with innovation too. Making sure school libraries have makerspaces is therefore dependent upon legislators and school administrators learning about the benefits of

makerspaces. School librarians must be trained in makerspace operations in order to support the children in an efficient manner.

Recommendations

1.   Alongside investing in infrastructure, stakeholders such as government, private individuals, and organizations should also invest in the school library, which serves as the intellectual hub of the school. School libraries must integrate makerspaces into their design to cultivate well-rounded students with current knowledge and skills.

2.   School administrators must be educated about the importance of establishing makerspaces in their school libraries. They should explore all avenues to ensure this objective is achieved. To effectively guide students, school librarians should be encouraged to possess the practical expertise and knowledge required to operate makerspaces.

3.   If professional associations like the Nigerian School Library Association, Nigerian Library Association, and the Librarianship Registration Council of Nigeria offer maker-space training, school librarians should enroll in the program.

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