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# Predictors of Use of School Library Makerspace by Secondary School Students in Ibadan, Nigeria

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# PREDICTORS OF USE OF SCHOOL LIBRARY MAKERSPACE BY SECONDARY SCHOOL STUDENTS IN IBADAN, NIGERIA

**BY**

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## Abstract

The use of school library makerspace by secondary school students could enhance their skills in Science, Technology, Engineering, Arts and Technology (STEAM). However, findings from empirical studies have revealed that the level of makerspace use by students in Nigeria seems to be low. This seemingly low level of makerspace use by students could be attributed to the perceived usefulness of makerspace from their perspective and their attitude towards innovation. Thus, this study examined the influence of these factors on the use of school library makerspace. The descriptive design of the correlational type was used and the study population consisted of 175 students of the Vale College, Ibadan, Nigeria, which is a secondary school that has a school library with a makerspace. The total enumeration technique was used to collect data from all the students with the aid of questionnaire. Data was analysed with the use of frequency counts, percentages, correlation and multiple regression analysis. Results showed that most of the respondents perceived the makerspace as useful, while they also had a positive attitude towards innovation. The most used tool in the makerspace was the furniture and the least used was the 3D scanner. Findings revealed that there was a significant positive relationship between perceived usefulness and use of makerspace and also between attitude towards innovation and use of makerspace. There was a joint significant influence of perceived usefulness and attitude towards innovation on the use of makerspace by the secondary school students. However, it was attitude towards innovation that had the greatest influence on the use of makerspace by the respondents. Based on the findings, it was recommended that school librarians and subject teachers should use every opportunity they have to encourage the students to use makerspace in order to enhance their STEAM skills.

## Keywords
Perceived usefulness, attitude towards innovation, use of school library makerspace, secondary school students, Nigeria

## Introduction

Secondary schools are educational institutions that are saddled with the responsibility of imparting young individuals with the knowledge of different subjects with a view to prepare them for higher form of learning. Nwakpa (2017) describes secondary school education as a

bridge between primary schools and tertiary institutions especially in the Nigerian context. The National Policy on Education (2004) of the Federal Ministry of Education of Nigeria states that recipients of this level of education should be able to acquire knowledge and skills that will enable them to provide for themselves. Secondary school students are expected to offer different subjects, complete various assignments and execute a number of projects during the course of their education. Thus, in a bid to assist the secondary school students with the necessary information resources needed for their academic activities, school libraries are established.

School libraries provide information resources in different formats in support of the learning activities of students at this level of education, as well as the space for them to read, study and interact with themselves. In order to ensure that secondary school students not only have theoretical knowledge, school libraries are retooling themselves through the creation of makerspace to serve as a form of practical laboratory (Honey and Kanter, 2013). Hussain and Nisha (2017) defined makerspace as a physical space in the library created to facilitate the sharing of information, knowledge, and experience between individuals of different backgrounds. Within the school library, makerspace provides the environment where students can create, invent and share knowledge especially in the areas of science, technology, engineering and mathematics (STEM).

Oyewole and Igbinovia (2017) noted that in addition to the provision of the conducive environment where secondary school students can make things, makerspace also provides the right tools. They listed some tools common in the makerspace for school libraries to include scrapbook paper, letter stickers, pipe cleaners, string, ribbon, crayons, sticky notes, elastics, magnets, pins, colored plastic, model magic, cardboard, wood, plastic and Styrofoam. Others are; beads/buttons, Popsicle sticks, LEGO, soldering irons, milling machine and laser cutter. However, Compton *et al*. (2014) observed that factors that could determine the tools to be included in the makerspace are the activities designed by the teachers, desired outcomes and budget.

Weisgrau (2015) pointed out that the use of the makerspace by students will give them the opportunity to learn in an informal manner and also give them equitable access to materials and resources. In the view of Hamilton (2012), when students make use of the makerspace, they engage in participatory learning that can improve their cognitive skills and development. However, despite the benefits associated with the use of makerspace by secondary school

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students, Okuonghae (2019) stated that the level of use of makerspace within the Nigerian environment is low. Perhaps, this low usage could be attributed to factors like the students' perception of the usefulness the makerspace and their attitude towards innovation which the use of this space requires.

Davis (1989) defines perceived usefulness as a degree to which a person believes that using a particular technology would enhance his/her performance. In this sense, makerspace is conceived as a platform that allows the use of various technologies to create practical things and perceived usefulness refers to how the secondary school students view this space as beneficial to their learning process. Perceived usefulness is one of the constructs in the Technology Acceptance Model 2 (TAM 2) which predicts the use of a technology. By implication, if the secondary school students believe that the use of the makerspace can assist them to acquire STEM skills within a short time; they might be motivated to use the space as often as they can.

Another factor that could influence the use of makerspace by the secondary school students is their attitude towards innovation. Merriam Webster Student Dictionary (2007) defines innovation as the introduction of something new. Attitude can be viewed as a cognitive assessment of an object with some degree of favor of disfavor (Eagly and Chaiken, 2007). Thus, the mental disposition that the secondary school students have towards the act of creating new things could influence their use of the makerspace. A student who is positively inclined towards innovation might be very willing and eager to explore the tools in the makerspace to develop an object. While one who has a negative attitude towards innovation might lack the enthusiasm to use the makerspace. In order to empirically ascertain these postulations, this work will examine the influence of perceived usefulness and attitude towards innovation on the use of makerspace by students of a secondary school in Ibadan, Nigeria.

**Research questions**

The following research questions will be answered in this study:

1. What is the perceived usefulness of the school library makerspace by the secondary school students in Ibadan, Nigeria?
2. What is the attitude of the secondary school students towards innovation?
3. What is the frequency of use of tools in the school library makerspace by the secondary school students in Ibadan, Nigeria?

4. What is the relationship between perceived usefulness and the use of school library makerspace by the secondary school students in Ibadan, Nigeria?

5. What is the relationship between the secondary school students' attitude towards innovation and the use of school library makerspace in Ibadan, Nigeria?

6. What is the relative and joint influence of perceived usefulness and attitude towards innovation on use of school library makerspace by the secondary school students in Ibadan, Nigeria?

**Literature review**

**Perceived usefulness of makerspace by students**

Blackley *et al.* (2018) carried out an interpretivist qualitative research on use of makerspace to design a Wiggle Bot by 291 Indonesia primary students. The students who participated in the study were in year 5 and 6 from four schools situated in North Jakarta. Results showed that almost all the students (98%) enjoyed making Wiggle Bot and of them commented "*I would like to continue to transform new things…and to enhance my knowledge*" These findings reveal that the students must have perceived the makerspace to be useful.

Moorefield-Lang and Coker (2017) examined the perception of makerspace by 13 high schools students of Monticello High School, Charlottesville, Virginia, United States of America. This school has a functioning makerspace and the students that participated in this qualitative research were those that regularly use the space. The researchers collected data through interview and some of the comments of the participants were; "*…it gives us our own space to do what we have to do…*" and "*I think the makerspace is great…I think it gives kids a change to bring out their creative side when they don't have an opportunity to do that*" These comments reveal that the students viewed the makerspace as useful.

Al-Mousawi (2018) carried out a study on the use of makerspace by 150 undergraduates of Kuwait University. The author used a quantitative research method and the questionnaire was the data collection instrument. Results showed that more than four-fifths of the respondents 123 (82%) perceived the makerspace to be an environment where projects and assignments can be done. In addition, a significant number of the undergraduates 92 (61.3%) were of the opinion that with makerspace in their library, they can develop the needed social and communication skills. From these findings, it can be concluded that majority of the respondents perceived makerspace

to be useful. The studies showed that a good number of students at different levels of education perceive makerspace to be useful.

**Attitude of students towards innovation**

Darwish-Holtta (2013) researched into how 32 international business students of Turku University of Applied Sciences in Finland viewed open innovation. An online questionnaire was sent to the respondents via Survey Monkey and from the findings 78% of the respondents considered the prospect of creating something that may be used elsewhere to generally be appealing. Also, a notable number of the students (81%) were of the view that they would like to be employed in organizations that would require them to use open innovation. These results implied that most of the respondents had a positive attitude towards innovation.

Ilbeykina *et al*. (2015) conducted a study on attitude towards innovation among 135 individuals out of which were 100 students who were studying different humanities courses in the Siberian Federal University, Krasnoyarsk, Russia. The researchers adopted the questionnaire as the data collection instrument and findings showed that close to three-fifths (59.1%) of the students noted that they understood the value of new ideas. In addition, 71% indicated that they valued news ideas for business. The pattern of these results shows that majority of the students had a positive attitude towards innovation.

Jurgena and Cedere (2016) examined the ideas of students on innovation in a tertiary institution. The participants included 192 first year students of the Riga Teacher Training and Educational Management Academy (RTTEMA), Latvia. From the findings, almost all the respondents, (90%), appreciated the inclusion of innovation at part of what should be taught in their institution. A notable number of the students (95%) had the disposition that innovation makes it possible for students to create opportunities to be creative and also make good use of their talents. This implies that most of the students in RTTEMA had an attitude that favoured innovation.

**Use of makerspace by students**

Julian and Parrot (2017) opined that students could make use of the makerspace to engage in cooperative activities. Fleming (2015) was the view that these activities could be carried out in the form of experimentation, exploration and play. The expected benefits that students might derive in the use of makerspace could influence how they use this provision. In

the qualitative study carried out by Moorefield-Lang and Coker (2017) among 13 high school students in Virginia, United States of America, all of them noted that they visited and use the makerspace in their school every week. The authors also reported that one out of the 13 students used the makerspace every day.

Galaleldin *et al*. (2017) surveyed the impact of makerspace on engineering education among 49 individuals among whom were 30 engineering students who make use of Ottawa Richard L'Abbe Makerspace, University of Ottawa, Canada. Results showed that one fifths of the respondents (20%) indicated that they used the makerspace on a weekly basis, 30% noted that they used the makerspace once a month and 35% only used the space once in a semester. In addition, 15% only used the makerspace occasionally.

**Perceived usefulness and use of makerspace by students**

Hartnett (2016) opined that makerspace would be considered useful by students as it could enhance their understanding of Science, Technology, Engineering, Arts and Mathematics (STEAM) through the collaborative learning system and peer interaction offered by the space. This implies that a student that has the perception that the use of makerspace could add to his or her knowledge on STEM might be encouraged to use space. Julian and Parrott (2017) after a review of makerspaces in the library concluded that learners are always motivated to use the makerspace because of the privilege that they have to work with different tools and devices and connecting with individuals of like minds to invent new things.

Yusuf *et al*. (2019) carried out a conceptual review of the role of makerspace in the educational setting and noted that students can benefit a lot from the use of makerspace as interactions with colleagues within the space could assist them to acquire lifelong skills that will be useful long after their schooling. Thus, the authors perceived that the use of makerspace by students could be a life changing factor. The implication of this is that if the students realise that the use of makerspace can be beneficial, they could be motivated to use makerspace to enhance their skills in STEAM.

**Attitude towards innovation and use of makerspace by students**

The attitude of students towards innovation to a greater extent could determine the use of makerspace. Mangiaracina (2017) was of the view that if students have a favourable disposition towards the creation of something new with the realisation that the use of makerspace could

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enhance their creativity, they could be motivated to use space. Consistent use of the tools in the makerspace could enhance the problem solving and creative skills of the students. Thus, Farritor (2017) advocated that the design of the makerspace should support innovation so as to facilitate utilisation.

Novak (2019) observed that students that do not the ability to think in a creative way with a view to create something new cannot benefit from the use of the makerspace. Bieraugel and Neill (2017) studied creativity and innovation in the use of academic library spaces by 226 students of the California Polytechnic State University. The result showed that use of makerspace ranked was a significant predictor of creativity and innovation of the students. Findings also revealed that students who were exposed to the use of makerspace were more innovative than those that did not.

**Conceptual model**

The conceptual model for the study is presented in Fig. 1.
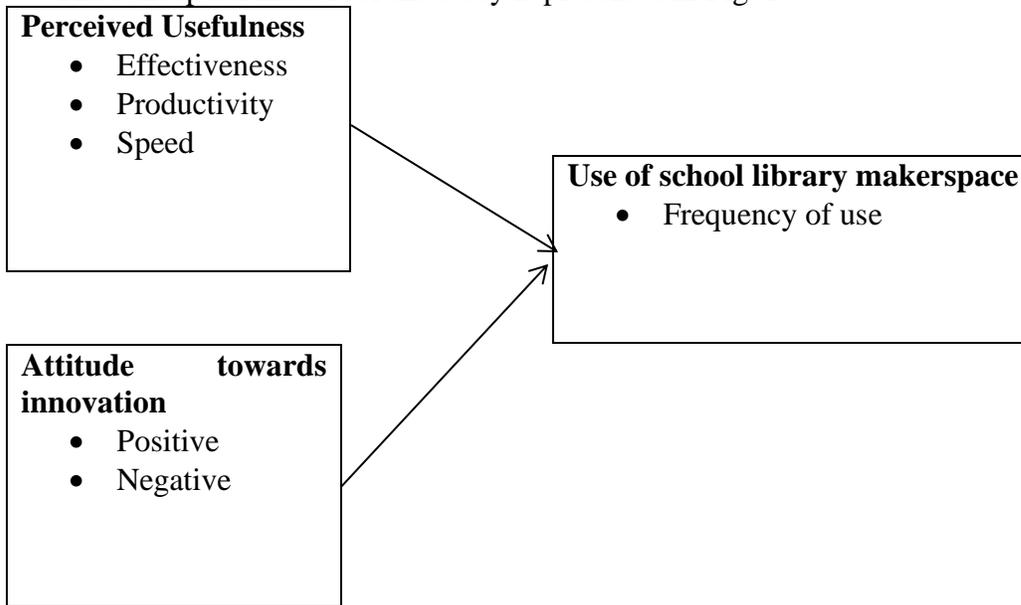


*Fig. 1: Self constructed model on perceived usefulness, attitude towards innovation and use of school library makerspace*

This model proposes a direct relationship between perceived usefulness and attitude towards innovation which are the predictors in this study (independent variables) and the use of school library makerspace (dependent variable). The model also presupposes the relative and joint influence of the independent variables to the dependent variable.

**Methodology**

The descriptive survey research design of the correlational type was used for the study. This design was considered appropriate as previous studies on the use of makserspace by students had adopted it with useful empirical results. The population of the study consists of all students of the Vale College Ibadan, Nigeria. This school is one of the few with a functional school library makerspace in the city of Ibadan, Oyo State, Nigeria. The data collected from the Administrative Unit of the school shows that the number of all the students in the school is 175. This number forms the population for the study (Table I). The total enumeration technique also called the census method was used for this study. This technique was adopted because the number of the respondents is manageable and the researcher can collect data within the allotted time. Thus, all students of the Vale College Ibadan participated in the study.

The questionnaire was the data collection instrument and it was divided in four sections. Section A elicits information on demographic information of the students with items such as; age, gender and class. This section consists of three close ended questions. Section B collects data on perceived usefulness of makerspace by the students with one question and twelve items. The scale by Davis (1989) was adapted to develop the items of perceived usefulness with indicators like effectiveness, productivity and speed. All the items were measured with a response format of agree and disagree. Section C covers attitude towards innovation and was developed based on an instrument created by Iibeykina *et al.* (2015) which was adapted. The section contains one question with eleven items. The response format for attitude towards innovation is "agree and disagree". Section D collects information on the frequency of use of tools in the makerspace with a response format of "daily, twice a week, weekly, monthly and never". The researchers distributed and retrieved completed copies of the instrument personally and data was analysed with the use of frequency counts, correlation analysis and multiple regression analysis with the aid of the Statistical Package for the Social Sciences (SPSS) Version 20.

**Table I        Population of the study**

| S/N | Class | Number of students |
|-----|-------|---------------------|
| 1 | Junior Secondary School (JSS) 1 | 25 |
| 2 | Junior Secondary School (JSS) 2 | 39 |

| 3 | Junior Secondary School (JSS) 3 | 27 |
|---|---|---|
| 4 | Senior Secondary School (SS) 1 | 30 |
| 5 | Senior Secondary School (SS) 2 | 21 |
| 6 | Senior Secondary School (SS) 3 | 33 |
| **Total** | | **175** |

Source: Field survey

## Results

### Questionnaire administration and return rate

A total number of 175 copies of the questionnaire were administered to the students of The Vale College and all the copies were duly filled and retrieved for data analysis. This gives a return rate of 100%.

### Demographic characteristics of the respondents

Table II presents the results of the demographic information of the respondents. Results showed that there were more female respondents 89 (50.9%) than their male counterparts 86 (49.1). JSS2 class had the highest number of respondents, 39 (22.3%), while the least came from SS2 21 (12.0%). Most of the respondents 91 (52.0%) were between 13-16 years of age, while the least 2 (1.1%) were between 17-20 years of age.

**Table II       Demographic characteristics of the respondents**

| Demographic characteristics | Freq. | % |
|---|---|---|
| **Gender** | | |
| Male | 86 | 49.1 |
| Female | 89 | 50.9 |
| **Class** | | |
| JSS1 | 25 | 14.3 |
| JSS2 | 39 | 22.3 |
| JSS3 | 27 | 15.4 |
| SS1 | 30 | 17.1 |
| SS2 | 21 | 12.0 |

| | | |
|---|---|---|
| SS3 | 33 | 18.9 |
| **Age** | | |
| 9-12 | 82 | 46.9 |
| 13-16 | 91 | 52.0 |
| 17-20 | 2 | 1.1 |

**N= 175**

## Answers to research questions

**Research question one: What is the perceived usefulness of the school library makerspace by the secondary school students in Ibadan, Nigeria?**

Perceived usefulness of makerspace was measured by three indicators; effectiveness, productivity and speed (Table III). Results showed that under effectiveness, most of the respondents 158 (90.3%) indicated that makerspace helped them to expand their knowledge. Also, a very high number of students 136 (77.7%) agreed that they visited the makerspace because it helped them to do their assignment and homework. As regards productivity, well above four-fifths 154 (88.0) and 147 (84%) pointed out that they learn new things by using the makerspace which also helped them to be more creative. As for the speed, majority of the respondents 146 (83.4%) indicated that their level of creativity receives a boost whenever they use makerspace, while 129 (73.7%) revealed that the use of makerspace helped them to complete their school assignment on time. Based on the results, it can be deduced that most of the respondents perceived makerspace to be useful.

**Table III Perceived usefulness of the school library makerspace by the secondary school students**

| Items | Agree | Disagree |
|---|---|---|
| **Effectiveness** | **F**<br>**%** | **F**<br>**%** |
| I visit makerspace because it helps me in doing my project or homework | 136<br>77.7 | 39<br>22.3 |
| Having a makerspace in the library can help me develop social and communication skills | 122<br>69.7 | 53<br>30.3 |

| | | |
|---|---|---|
| Makerspace can help to expand my knowledge | 158<br>90.3 | 17<br>9.7 |
| Makerspace supports collaboration between peers | 129<br>73.7 | 46<br>26.3 |
| **Productivity** | | |
| The use of makerspace can assist me to have better grades | 144<br>82.3 | 31<br>17.7 |
| I can learn new things by using the makerspace | 154<br>88.0 | 21<br>12.0 |
| Use of makerspace enhances creativity | 147<br>84.0 | 28<br>16.0 |
| Makerspace helps me develop problem solving skills | 145<br>82.9 | 30<br>17.1 |
| Use of makerspace assists me to complete assigned projects | 130<br>74.3 | 45<br>25.7 |
| **Speed** | | |
| I generate ideas quickly when I am in the company of my peers in the makerspace | 117<br>66.9 | 58<br>33.1 |
| Use of makerspace helps me to complete my school assignment on time | 129<br>73.7 | 46<br>26.3 |
| My creativity level receives a boost whenever I use makerspace | 146<br>83.4 | 29<br>16.6 |

**Research question two: What is the attitude of the secondary school students towards innovation?**

Table IV showed that a notable number of the respondents 157 (89.7%) agreed that they feel excited when they come up with new ideas. A little above four-fifth 145 (82.5%) believed that everyone comes up with new ideas from time to time and 141 (80.6%) agreed that ideas that are not common may turn out to be useful. Also, most of the students 150 (85.7%) students disagreed that listening to other people's idea is a waste of time, while a significant number 122 (69.7%) indicated that the ability to generate new ideas is not the exclusive preserve of the most intelligent and educated. Based on the result, it can be deduced that most of the respondents had a positive attitude towards innovation.

**Table IV        Attitude of the secondary school students towards of innovation**

| Items | Agree F % | Disagree F % |
|---|---|---|
| I often come up with new ideas based on ideas by other people | 103 58.9 | 72 41.1 |
| I am really happy when I am challenged to find a new way to solve problem | 128 73.1 | 47 26.9 |
| I do not have enough time to come up with unique ideas because I am already too busy trying to cope with school activities | 93 53.1 | 82 46.9 |
| I feel excited when i come up with new ideas | 157 89.7 | 18 10.3 |
| New ideas are important only if they have effects on my school work | 60 34.3 | 115 65.7 |
| Everyone comes up with creative ideas from time to time | 145 82.9 | 30 17.1 |
| Ideas that are not common may turn out to be useful | 141 80.6 | 34 19.4 |
| Listening to other peoples' idea is a waste of time | 25 14.3 | 150 85.7 |
| The more challenges I have, the more opportunities arise | 138 78.9 | 37 21.1 |
| Only the most intelligent and educated people can generate good ideas | 53 30.3 | 122 69.7 |
| Some people really amaze me with their innovative ideas | 140 80.0 | 35 20.0 |

**Research question three: What is the frequency of use of tools in the school library makerspace by the secondary school students in Ibadan, Nigeria?**

Table V revealed that the tools that were used daily by most of the respondents 133 (76.0%) were furniture (tables, chairs, dusters and whiteboard), pen 131 (74.9%) and paper 130 (74.3%) respectively. On the other hand, the tools that were never used were 3D scanner 151 (86.3%), 3D printer 147 (84.0%), drill bits 143 (81.7%) and sewing machines 119 (68.0%) as noted by the students.

**Table V**  **Frequency of use of tools in the school library makerspace by the secondary school students**

| Tools | Daily F % | Twice a week F % | Weekly F % | Monthly F % | Never F % |
|---|---|---|---|---|---|
| 3D printer | 5 2.9 | 6 3.4 | 10 5.7 | 7 4.0 | 147 84.0 |
| 3D scanner | 4 2.3 | 5 2.9 | 10 5.7 | 5 2.9 | 151 86.3 |
| Rubber bands | 68 38.9 | 16 9.1 | 21 12.0 | 22 12.6 | 48 27.4 |
| Paper | 130 74.3 | 12 6.9 | 15 8.6 | 12 6.9 | 6 3.4 |
| Cardboard | 52 29.7 | 23 13.1 | 33 18.9 | 48 27.4 | 19 10.9 |
| Scissors | 65 37.1 | 23 13.1 | 31 17.7 | 31 17.7 | 25 14.3 |
| Pen | 131 74.9 | 6 3.4 | 16 9.1 | 15 8.6 | 7 4.0 |
| Dute tape | 30 17.1 | 30 17.1 | 30 17.1 | 29 16.6 | 56 32.0 |
| Glue | 51 29.1 | 24 13.7 | 37 21.1 | 40 22.9 | 23 13.1 |
| Computer | 53 30.3 | 41 23.4 | 41 23.4 | 17 9.7 | 23 13.1 |
| Marker | 46 26.3 | 23 13.1 | 40 22.9 | 22 12.6 | 44 25.1 |
| Box knives | 18 10.3 | 15 8.6 | 11 6.3 | 23 13.1 | 108 61.7 |
| Sewing machines | 6 3.4 | 12 6.9 | 16 9.1 | 22 12.6 | 119 68.0 |
| Software (autocad) | 7 4.0 | 12 6.9 | 16 9.1 | 34 19.4 | 106 60.6 |
| File cards | 14 8.0 | 16 9.1 | 14 8.0 | 29 16.6 | 102 58.3 |
| Sewing needles | 38 21.7 | 21 12.0 | 24 13.7 | 30 17.1 | 62 35.4 |
| Furnitures (tables, chairs, dusters, whiteboard) | 133 76.0 | 8 4.6 | 9 5.1 | 16 9.1 | 9 5.1 |
| Pins | 60 34.3 | 35 20.0 | 20 11.4 | 11 6.3 | 49 28.0 |
| Drill bits | 4 2.3 | 8 4.6 | 12 6.9 | 8 4.6 | 143 81.7 |

**Research question four: What is the relationship between perceived usefulness and the use of school library makerspace by the secondary school students in Ibadan, Nigeria?**

Results in Table VI showed that there is significant relationship between perceived usefulness of makerspace and the use of the school library makerspace (r = .206**; df = 174; p< 0.05). This implies that the more the students perceive makerspace to be useful, they will make use of it.

**Table VI Relationship between perceived usefulness and use of school library makerspace**

| Variable | Mean | SD | Df | N | R | P(sig) | Remark |
|---|---|---|---|---|---|---|---|
| Perceived Usefulness | 20.67 | 2.27 | | | | | |
| Use of makerspace | 34.07 | 9.63 | 174 | 175 | .206** | .006 | Sig |

**Research question five: What is the relationship between the secondary school students' attitude towards innovation and the use of school library makerspace?**

Findings in Table VII revealed that there is significant relationship between the attitude of students towards innovation and the use of makerspace (r = .169*; df = 174; p< 0.05). This implies that the more positive the attitude of students towards innovation, the more they are likely to use the makerspace.

**Table VII Relationship between the attitude of students towards innovation and use of school library makerspace**

| Variable | Mean | SD | Df | N | R | P(sig) | Remark |
|---|---|---|---|---|---|---|---|
| Attitude of students | 17.76 | 1.29 | | | | | |
| Use of makerspace | 33.72 | 10.18 | 173 | 175 | .169* | .026 | Sig |

**Research question six: What is the relative and joint influence of perceived usefulness and attitude towards innovation on use of school library makerspace by the secondary school students in Ibadan, Nigeria?**

Table VIII presents the results of the relative contribution of the independent variables to the dependent variable, expressed as beta weights, attitude toward makerspace ($\beta$ = .183, t = 2.460; P <.05), perceived usefulness, ($\beta$ = .174, t = 2.332; P <.05) both had significant relative contribution on the criterion. However, it is attitude towards innovation that significantly predicts the use of makerspace by the secondary school students.

**Table VIII Relative contribution of perceived usefulness and attitude towards innovation on use of school library makerspace by secondary school students**

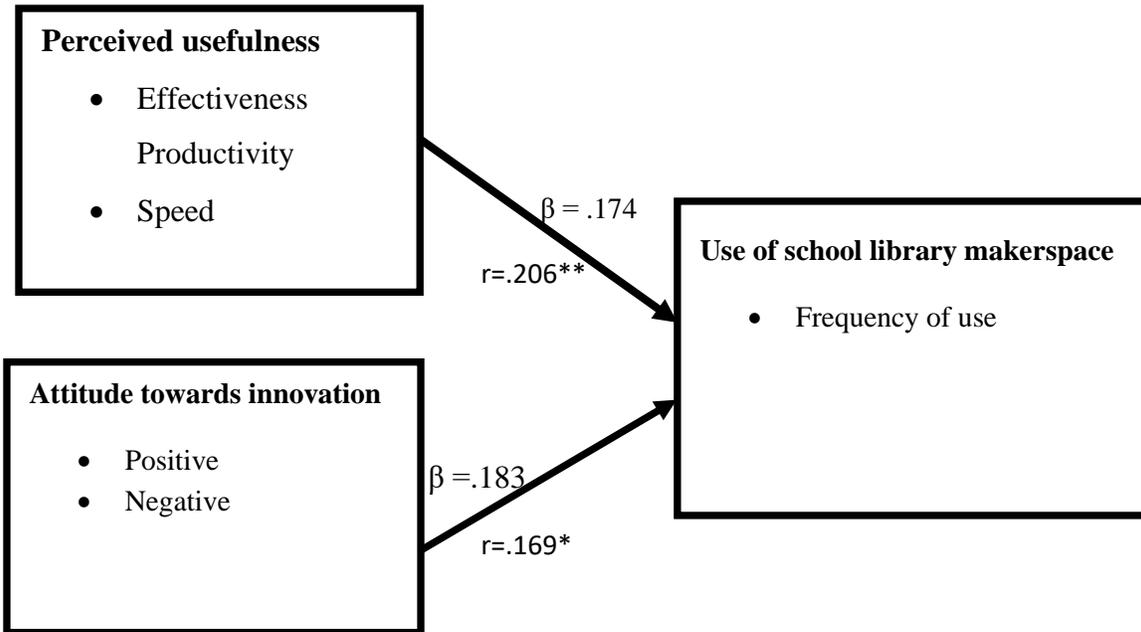| Model | Unstandardized Coefficients | | Standardized Coefficients | T | Sig. |
|---|---|---|---|---|---|
| | B | Std. Error | Beta | | |
| (Constant) | .978 | 8.905 | | .110 | .913 |
| Perceived usefulness | .736 | .315 | .174 | 2.332 | .021 |
| Attitude towards innovation | .998 | .406 | .183 | 2.460 | .015 |

Dependent Variable: Use of school library makerspace

Table IX shows that joint influence of the independent variables (perceived usefulness and attitude towards innovation) on the prediction of the dependent variable (use of school library makerspace) was significant. The table also shows an adjusted $R^2$ of .027. This means that 2.7% of the variance (use of makerspace) was accounted for by the two predictors when taken together. The significance of the composite contribution was tested at P < .05. The table also shows that the analysis of variance (ANOVA) for the regression yielded a F-ratio of 3.391 (significant at 0.05 level). This implies that the joint contribution of the two independent variables to the dependent variable was significant and that other variables not included in this study may have accounted for the remaining variance.

**Table IX Joint influence of perceived usefulness and attitude towards innovation on use of school library makerspace by secondary school students**

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|---|---|---|---|---|
| 1 | .195[a] | .038 | .027 | 10.03885 |

| ANOVA | | | | | | |
|---|---|---|---|---|---|---|
| Model | | Sum of Squares | Df | Mean Square | F | Sig. |
| 1 | Regression | 683.392 | 2 | 341.696 | 3.391 | .036[b] |
| | Residual | 17333.888 | 172 | 100.778 | | |
| | Total | 18017.280 | 174 | | | |

**Resultant model of the study**



```
Perceived usefulness
  • Effectiveness
    Productivity
  • Speed
                              β = .174
                              r=.206**
                                                Use of school library makerspace
                                                  • Frequency of use
Attitude towards innovation
  • Positive
  • Negative
                              β =.183
                              r=.169*
```

**Discussion of the findings**

Findings showed that majority of the secondary school students perceived the school library makerspace to be useful. This could be as a result of the awareness created by their

teachers and the personnel in charge of the makerspace, as the more they are aware of the benefits associated with the use of the makerspace, the more their perception towards it will tend to be positive. This supports the result of the study conducted by Al-Mousawi (2018) where it was reported that most of the students that participated in the study perceived makerspace to be useful.

Most of the respondents had a positive attitude towards innovation. This disposition is very essential if the students are to develop into experts in STEAM later in life. A student that has a negative attitude towards innovation might not have the needed impetus to be an innovator. This result corroborates that the findings of the studies of Darwish-Holtta (2013) and Jurgena and Cedere (2016) where they reported that their respondents (students of higher institutions) had a positive attitude towards the art of creating something new. There is a possibility that these students might have developed this positive attitude towards innovation during their elementary and secondary education.

From the findings, the respondents used the school library makerspace at different frequencies with furniture among the most used item and 3D scanner among the least used. This variation in the use of the tools in the makerspace may be due to the ease associated with the use of furniture and the inability to effectively put the 3D scanner to use. Nevertheless, the fact that the tools in the makerspace are not totally neglected by the students is significant. This agrees with the results of the study conducted by Galaleldin *et al*. (2017) where findings revealed that makerspace was used by the respondents either on a weekly or monthly basis by majority of them.

There was a positive significant relationship between perceived usefulness and use of school library makerspace by the secondary school students. This connotes that the students need to have that mental conviction that makerspace is useful before they can replicate that in their actual usage of the space. This position aligns with that of Yusuf et al. (2019) who opined that if the students are convinced that they can acquire skills that would be beneficial to them even after the completion of their secondary school education, they could be motivated to use it.

Findings showed a positive relationship between attitude towards innovation and use of school library makerspace by the respondents. The students need to be innovative if they are use the makerspace for the purpose of its establishment in the school. Without being innovative, it would be difficult for the students to create new things from the different tools available in the

makerspace. This confirms the submission of Novak (2019) who opined that the ability to be innovative is a critical factor in the successful use of makerspace by the students.

Results also showed that perceived usefulness and attitude towards innovation were significant predictors of the use of school library makerspace by the respondents. However, attitude towards innovation is the most significant factor to be considered in order to ensure the effective use of makerspace by the second school students. This further highlights the need for students to have a positive attitude towards innovation very early in their educational sojourn as this would have been part of them by the time they proceed to higher educational institutions. In order to ensure this, there is a need for them to continually use the makerspace as it provides the environment where their creativity can be enhanced. This agrees with the result of the study carried out by Bieraugel and Neill (2017) where it was reported that the use of makerspace by students could improve their creativity and innovation.

**Conclusion**

The use of school library makerspace by secondary school students is critical if they are to develop important skills associated with problem solving and critical thinking. These skills can be sharpened with the interactions with colleagues and collaborative opportunities that the makerspace provides. A secondary school student that has access to use the makerspace and yet fails to use this facility would miss out on the opportunity to develop skills that could be useful later in life, skills that could help change the society in the STEAM areas. However, for secondary school students to effectively use the makerspace, they must perceive that they would benefit a lot from its use and must also have a disposition that favours the creating of new things (innovation). These two factors could propel the students to use the school library makerspace for its intended purpose. Thus, perceived usefulness and positive attitude towards innovation are important predictors of the use of school library makerspace by the secondary school students.

**Recommendations**

Based on the findings and the conclusion, the following recommendations are made:

1.  In order to sustain the perceived usefulness of makerspace by the students, teachers in collaboration with the school librarian should regularly talk to the students about the benefits associated with the use of makerspace and also ensure that the students have specific times in which they have to visit the makerspace to work.

2. The positive attitude towards innovation on the part of the students can be sustained if the school management motivates students who are creative with recognition, awards and financial support. If the students realise that innovation is appreciated in the school and not suppressed, they would be motivated to do more.

3. In order to ensure that the tools in the makerspace are used effectively, the librarian should provide guidance and training on how the different tools can be used and what they are capable of doing with them. If the students have the knowledge and skills in using the tools, they would use them creatively.

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