

## PERCEIVED IMPACT OF THE USE OF INTERNET RESOURCES ON UNDERGRADUATE STUDENTS' ACADEMIC ACHIEVEMENT IN MATHEMATICS: IMPLICATION FOR PHYSICS AND ENGINEERING TEACHING

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### ABSTRACT

*This study was carried out to investigate the perceived impact of the use of internet resources on undergraduate students' academic achievement in Mathematics and its implications for Physics and Engineering teaching. The study employed a descriptive survey research design using a sample of one hundred (100) undergraduate students (52 males and 48 females). The sample comprised 60 pure Mathematics students and 40 Mathematics Education students. The Instrument used for data collection was titled "Questionnaire on the Impact of the Use of Internet Resources on Academic Achievement in Mathematics" (QUIRAAM) structured on a four-point Likert scale. The research instrument was validated by three experts. Cronbach Alpha technique was used to ascertain the internal consistency reliability of the items of the instrument and a reliability index of 0.815 was obtained. The research questions were answered using mean and standard deviation while t-test of independent samples was used to test the null hypotheses at 0.05 level of significance. The findings of the study revealed that academic-oriented use of internet resources positively impacts on undergraduate students' achievement in Mathematics. The findings also showed that there was no significant difference in academic-oriented use of internet resources for learning Mathematics concepts between undergraduate students in pure Mathematics and those in Mathematics Education. The study also found that there was no significant influence of gender on undergraduate students' use of internet resources for learning Mathematics concepts. This finding implicates Physics and Engineering teaching at University level in that the use of internet resources in the teaching of Physics and Engineering courses by the lecturers will lead to improved performance of students in physics and engineering since Mathematics is closely related to Physics and Engineering. Based on the findings of the study, it was recommended among others that internet resources should be made adequately available in Universities through collaborative efforts of the University authorities, policymakers, government, and non-governmental organizations.*

**KEYWORDS:** Academic Achievement, Internet Resources, Mathematics, Physics and Engineering Teaching

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### INTRODUCTION

Mathematics is a branch of science concerned with numbers, quantity, and space, either as abstract concepts (pure mathematics) or as applied to physics, engineering, and other subjects (applied mathematics). Mathematics refers to the concept that studies about arithmetic, algebra, geometry, and trigonometry. Mathematics is a broad subject that touches every facet of modern society. This is to say that mathematics is an indispensable and essential tool for the

scientific and technological development of a nation, but the subject has witnessed a poor performance of students over the years.

Onah et al. (2020) opined that the rate of students' poor performances in mathematics in external examinations in Nigeria is becoming a disturbance to educators of Mathematics and such calls for immediate attention. Besides, Ugwuanyi, Okeke and Asomugha (2020) revealed that students' poor performance in mathematics examinations in Nigeria worries both mathematics educators and parents. According to Iyi (2016) as cited in Onah et al. (2020), the percentage pass in mathematics with credit and above in Nigeria was 23.0% in 2009, 31.0% in 2010, 24.94% in 2011, and 38.98% in 2012, 38.68% in 2015. In recent years, a higher percentage of undergraduate students perform relatively poorly in mathematics courses which may be due to the way the concepts are being presented or the complex nature of mathematics concepts. These undergraduate mathematics students are students from the Department of Pure Mathematics and the Department of Science Education (Mathematics unit). Both departments offer mathematics courses up to the graduate level in the university while other departments offer it an auxiliary course and drop it at a certain level. These students offer mathematics courses due to the general importance of mathematics to the development of the individual and the society at large. Despite the importance placed on the subject, mathematics courses are one of the most poorly taught, widely hated, and abysmally understood in higher institutions. Agwagah (2004) lamented that despite all the important roles mathematics plays in the development of mankind, its achievement has been very poor at all levels of education. The researcher further revealed that even though the indispensability of mathematics in the development of our society has been universally acknowledged, the output of its teaching and learning is still not encouraging.

Obodo (2004) stated that throughout Nigeria, at all levels of education - primary, secondary, and tertiary, the performance of pupils/students in mathematics is at a very poor state. This is evident as the result of students in mathematics at the graduating class of each level of education kept on deteriorating year in year out. This ill wind of poor achievement in mathematics is not only witnessed in Nigeria as Mathematical Association of America (MAA) (2013) in their summary of students' academic achievement in mathematics revealed that 50 percent of university students do not pass calculus and analysis with a grade of C or above. This disheartens high failure rate in mathematics at both pre-tertiary and tertiary levels has bothered the minds of many researchers, authors, and mathematics educators and even the government and attempts are being made to proffer some solutions. Hence, many researchers, mathematics educators, and concerned individuals have been considering ways and means of ensuring effective teaching and learning of mathematics in schools that can enhance students' achievement.

Achievement means to reach a required standard of performance and to carry out successfully a task. It involves the determination of the degree of attainment of individuals in tasks, courses, or programs to which the individuals were sufficiently exposed. Academic achievement has long been recognized as one of the important goals of education. Academic achievement refers to the average marks obtained by an individual in the final examination. According to Schunk (2008), high achievers usually possess high self-efficacy levels while the converse is true of low achievers. Schunk further stated that academic achievement is a product of several factors operating within the individual and outside him. Students' academic achievement entails successful academic progress attained through effort and skill. The academic achievement could be the level of proficiency and knowledge demonstrated by an individual after learning has occurred.

In tertiary institutions just like other levels of education, mathematics achievement of students can influence their achievements in the future, maybe in their further studies or future careers. Also, the success students achieve in

mathematics has consequences not only for the students' personal and professional lives but also for national development (Wilkins & Ma, 2002). Therefore, students' achievement in mathematics has to be given utmost attention at all levels of education. Therefore, a solid background in mathematics from pre-tertiary to tertiary level is very important as it will help to develop intellectually appealing students who can view things in their relative importance and hence offers them career options to choose from. According to Wilkins & Ma, the importance of mathematical learning has repeatedly been emphasized by educators and policymakers. As a result, the stakeholders in education (teachers, parents, students, educators etc) have paid attention to the progressive achievement of students in mathematics yearly. These stakeholders especially the teachers, parents, and educators should try to recognize the factors that are influencing the students' achievement in mathematics especially undergraduate students to proffer some improvement strategies and close the gap in students' achievement in mathematics. Thus, according to Ma and Klinger (2000), mathematics educators have relied on many sources of information and focused on various factors that might affect students' mathematics achievements to include students' backgrounds, peer environment, parental involvement, students' characteristics, students' use of internet resources, gender, age, collaborative learning, ethnicity, family characteristics, marital status, and socioeconomic status. Considering the impact of the above factors one by one on students' mathematics achievement is necessary, especially at tertiary schools where the highest levels of mathematics are taught. According to Nwaocha (2010), the process of learning mathematics is a very complex cognitive task that can be very imposing on undergraduate students since it requires a lot of effort from them. Consequently, these students need a lot of active involvement in the teaching and learning process to cope with the subject. It is therefore within the benefit of education to use strategies that may be interesting to the students' learning such as learning through internet resources (one of the factors mentioned above) especially now that the internet has turned the whole world into a global village.

The Internet, which is an electronic communications network, globally through computer networks provides varieties of information to students using standard communication patterns. The information about the education system today full everywhere in the internet. That is why students can use the internet to satisfy their intellectual curiosity. The academics increasingly depend on the Internet for educational purposes (Gupta & Sanocki, 2002). In the words of Agil and Ahmad (2011), the internet is the transport vehicle for the information stored in files or documents on a computer. It carries together various information and services, such as electronic mail, online chat, file transfer, the interlinked Web pages and other documents of the World Wide Web (WWW). All these can be used by undergraduate students in learning mathematics. So, the Internet plays a vital role in the teaching and learning of mathematics concepts especially in the tertiary institutions where students are already matured and can access the sites. Ogedebe, (2012) states that updated and current information is well organized on the internet for easy search and has contributed significantly to students' academic laurels and achievement. The use of the internet creates awareness of the importance of the world around the students.

The ways and rates at which the students get and share information are rapidly increasing in the tertiary institutions due to the use of the internet. They no longer rely solely on the information from the teachers and maybe hard copy textbooks that are available. No wonder Siraj et al. (2015) said that the internet is the key information and communication technology that led to a worldwide revolutionary change in the information scenario. The internet is a pool of knowledge in which any country that fails to provide her youth especially the undergraduate students access to the use of internet resources is unseating the country from her throne of dignity among other dignitaries (Olatokun, 2008). It is developed to serve as a platform for various activities for all students in society. The students can access the internet using the resources available to them for academic work. The availability of the internet is almost everywhere, and most

undergraduate students have had access to the internet on their cell phones (Ellore et al., 2014). So, the undergraduate students can access their academic information from the internet any time to update their knowledge especially after class and this may help in enhancing their academic performance.

However, despite the significance of the internet to students' academic pursuits, some students still use it for other non-academic motives which usually have numerous negative impacts on their academic performance. It has been noted that some students use the internet for non-academic purposes such as gaming and social networking, thus culminating in the loss of study schedules (Singh et al., 2013). Students also use the internet for leisure rather than educational purposes (Olatokun, 2008) and this can lead to fallen academic standards. From the foregoing, it can be observed that the topmost uses of the internet by university students is for charting, downloading of music, watching videos online, playing online games, and online shopping. But the internet can only be a bad tool for higher academic achievement if its usage is not controlled (Mami & Hatami-Zad, 2014). Researchers like Torres-Diaz et al. (2016) found that a balanced use of the internet leads to greater academic success among students. Similar studies have found that information communication technology had significant impacts on students' performance in Mathematics (Onah et al., 2020), Science (Ugwuanyi et al., 2019a, 2019b; Ugwuanyi et al., 2020a, 2020b, 2020c, 2020d; Ugwuanyi & Okeke, 2020) and Social Science (Ejimuonye et al., 2020a, 2020b) courses. This is true because if the students engage the internet for academic purposes using a small part of their leisure or resting time, and then use it extensively afterward for pure academic purposes in learning the contents of different subjects taught, their achievement may be beefed up. This will be achieved with the judicious use of internet resources.

Internet resources are the tools necessary in the effective performance of tasks and for the growth and development of human organizations (Jason, 2011). They are aids rendered to accomplish or achieve a goal. In other words, information is sourced from the Internet by utilizing its (Internet) resources. In the words of Wood (2011), Internet resources refer to the intangible/tangible activities/facilities/tools or equipment, software that can aid or help the users of the Internet to achieve benefits. These resources are, therefore, the means through which the Internet is accessed. The Internet has many resources that can be utilized for research by individuals. For academic search, such resources include Internet-enabled electronic devices; Internet Network facilities; Internet Browsers such as Google Chrome, Internet Explorer, Opera, and Mozilla Firefox; Internet Search engines; Social Network technologies or sites; services; and Electronic Library resources (Bradley, 2014). The usefulness of internet resources in settling many academic cases and the fact that students perform relatively poor in mathematics at different levels of education is what prompted the researchers to investigate the impact of the use of internet resources on undergraduate students' academic achievement in mathematics.

## **STATEMENT OF THE PROBLEM**

Mathematics education in Nigeria appears to be in crisis as reflected in the poor achievement of students in undergraduate examinations. These failures in mathematics which also includes university students have a significant and serious impact on the educational advancement of students and nation at large. It impedes the achievement of the national objectives of science and technological development which depend tremendously on mathematics. Also, Poor access to internet resources, services, and facilities for learning mathematics concepts may adversely affect their achievement.

Nevertheless, some factors like; lack of students' interaction and cooperation, the inability of students to acquire learning materials, poor involvement of students on collaborative learning as well as the inability of students to use the internet to procure relevant materials for solving a particular mathematical problem, and inadequate use of multimedia in

learning mathematics may also contribute to their achievement negatively and needs to be investigated. The problem of this study, therefore, is to investigate the impact of the use of internet resources on undergraduate students' academic achievement in mathematics. In other words, the study sought to investigate whether academic-oriented use of internet resources affects undergraduate students' academic achievement in mathematics and to determine if there is any influence of gender on undergraduate students' use of the internet for learning mathematics concepts in the universities.

## RESEARCH QUESTIONS

The following research questions have been posed to guide this study:

- What are the impacts of academic-oriented use of internet resources on undergraduate students' academic achievement in mathematics?
- What is the influence of gender on undergraduate students' use of internet resources for learning mathematics concepts in universities?

**H<sub>01</sub>:** There is no significant difference in academic-oriented use of internet resources for learning mathematics concepts between undergraduate students' in pure mathematics and those in mathematics education.

**H<sub>02</sub>:** There is no significant influence of gender on undergraduate students' use of internet resources for learning mathematics concepts.

## METHODS

This research employed a descriptive survey research design. A descriptive survey research design is one which is aimed at collecting data, and describing systematically the characteristics, features, or facts about a given population (Nworgu, 2015). A descriptive survey research design is appropriate for this study because of the large population. The study was carried out at the University of Nigeria, Nsukka, due to the availability of internet resources and facilities such as Wi-Fi, laptops in the school. It also provides a constant power supply.

The population of the study comprised all undergraduate students in the Department of Mathematics and Department of Science Education at the University of Nigeria, Nsukka. Purposive sampling technique was used to select the Pure Mathematics and Mathematics Education unit of Science Education from the two Departments specified in the population. This was because their students offer related mathematics courses from their first to the fourth year in the university. The sample of this study comprised 100 pure Mathematics and Mathematics Education undergraduate students (52 males and 48 females) of the University of Nigeria, Nsukka who were gotten through proportionate random sampling. This sample of 100 is made up of 60 pure Mathematics and 40 Mathematics Education students. The Instrument used for data collection was a Questionnaire on the Impact of the Use of Internet Resources on Academic Achievement in Mathematics (QUIRAAM) structured on a four-point Likert scale. The questionnaire was subjected to face and content validation by three (3) experts of the University of Nigeria Nsukka. The reliability of the instrument was ascertained using Cronbach Alpha with an index of 0.815.

The data were collected and analyzed through basic methods of both descriptive and inferential statistics. Specifically, the research questions were answered using mean and standard deviation. A criterion mean of 2.50 was used for making remarks on the research questions. Also, t-test was used to test the hypotheses at 0.05 level of significance.

## RESULTS

Data were analyzed, summarized, and presented in the following Tables below according to their respective research questions and hypotheses.

### Research Question One

What are the impacts of academic-oriented use of internet resources on undergraduate students' academic achievement in mathematics?

**Table 1: Mean Analysis of the Perceived Impact of Academic Oriented Use of Internet Resources on Undergraduate Students' Academic Achievement in Mathematics**

S/N		n	Mean	Std. Deviation	Remarks
1	It provides relevant mathematics materials such as textbooks and electronic books to students at a low cost.	100	3.63	.59	Accepted
2	It improves students' self-learning skills of abstract mathematics concept	100	3.43	.68	Accepted
3	It provides video clips that solve a given mathematics problem	100	3.64	.54	Accepted
4	It serves as a source of solution to students' mathematics assignment through the use of search engines	100	3.41	.57	Accepted
5	It allows students to search for current information in Online mathematics journals and articles	100	3.58	.55	Accepted
6	It provides electronic software for the Career development of mathematics students.	100	3.29	.64	Accepted
7	It is a source of virtual mathematics library which provides mathematics document with portable document format (pdf) file extensions	100	3.67	.60	Accepted
<b>GRAND MEAN</b>				<b>3.570.37</b>	<b>Accepted</b>

From Table 1, all the seven items 1-7 with their mean ranging from 3.29 to 3.67 were accepted as they are above the 2.5 benchmark. The standard deviation of all the items which ranged from 0.54 to 0.68 shows that all the respondents are relatively not far from one another in their individual opinions. The grand mean of 3.51 and a standard deviation of 0.37 respectively indicated that academic-oriented use of internet resources positively affects undergraduate students' achievement in mathematics.

**H<sub>01</sub>:** There is no significant difference in academic-oriented use of internet resources for learning mathematics concepts between undergraduate students' in pure mathematics and those in mathematics education.

**Table 2: t-Test of the Perceived Impact of Academic Oriented Use of Internet Resources for Learning Mathematics Concepts between Undergraduate Students' in Pure Mathematics and Students in Mathematics Education**

Students Department	n	Mean	Std. Deviation	df	t	Sig(2-tailed) Remarks
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Pure Mathematics	60	3.47	.35	98	-1.519	.132	Not Significant
Mathematics Education	40	3.58	.38				

Table 2 shows that the aggregate mean ratings of Pure Mathematics ( $M = 3.47, SD = .35$ ) and Mathematics Education ( $M = 3.58, SD = .38$ ) undergraduate students on academic-oriented use of internet resources for learning mathematics concepts. The corresponding standard deviations are 0.35 and 0.38. The Table also reveals that there was no significant difference in academic-oriented use of internet resources for learning mathematics concepts between undergraduate students' in pure mathematics and those in mathematics education,  $t(98) = -1.519, p = .132$ .

### Research Question Two

What is the influence of gender on undergraduate students' use of internet resources for learning mathematics concepts in the universities?

**Table 3: t-Test Analysis of the Influence of Gender on Undergraduate Students' use of Internet Resources for Learning Mathematics Concepts**

Gender	n	Mean	Std. Deviation	df	t	Sig(2-tailed)	Remarks
Male	52	3.65	.42	98	1.664	.099	Not Significant
Female	48	3.52	.55				

Table3 shows that the male undergraduate students had a mean rating of ( $M = 3.65, SD = .42$ ) on the use of internet resources for learning mathematics concepts while their female counterparts had a mean rating of ( $M = 3.52, SD = .55$ ). This indicates that male undergraduate students had a higher mean rating than their female counterparts.

**H<sub>02</sub>:** There is no significant influence of gender on undergraduate students' use of internet resources for learning mathematics concepts.

Table 3 revealed that there was no significant influence of gender on undergraduate students' use of internet resources for learning mathematics concepts,  $t(98) = 1.664, p = .099$ . Thus, the null hypothesis was not rejected.

### DISCUSSION OF FINDINGS

The result from Table 1 revealed that academic-oriented use of internet resources has positive significant impacts on undergraduate students' academic achievement in mathematics. This means that academic-oriented use of internet resources from items 1 through 7 can help in increasing the undergraduate students' achievement in mathematics. This is in agreement with the findings of Torres-Díaz et al., (2016) who reported that a balanced use of internet resources leads to greater academic success among undergraduate students. Similar studies have found that information communication technology had significant impacts on students' performance in Mathematics (Onah et al., 2020), Science (Ugwuanyi et al., 2019a, 2019b; Ugwuanyi et al., 2020a, 2020b, 2020c, 2020d; Ugwuanyi & Okeke, 2020) and Social Science (Ejimuonye et al., 2020a, 2020b) courses. However, Franklina (2018) in a study of internet use and its impact on Senior High School students in the Wa Municipality reported that different uses of the internet among students do not influence their academic performance. The reason for the disagreement might be that the respondents of the reviewed research are not up to university level students and maybe less matured to make better use of the internet for academic purposes.

The data presented in Table 3 revealed that the p-value is greater than the criterion value, thus the null hypothesis is then accepted. Hence, there is no significant difference in academic-oriented use of internet resources for learning mathematics concepts between undergraduate students' in pure mathematics and those in mathematics education. This is in

line with the findings of Olatokun (2008) and Nancy (2014), who found no significant difference in the use of internet resources for research projects across the departments.

The findings from the data presented in Table 2 showed that there is no significant influence of gender on undergraduate students' use of internet resources for learning mathematics concepts. This is in line with Mami & Hatami-Zad (2014) who found no significant difference between male students and female students' use of internet resources in universities with regards to internet addiction. However, the finding contradicts Gross (2004) whose result showed a significant gender difference in the usage of the internet for research.

## **CONCLUSIONS**

Academic oriented use of internet resources positively impacts on undergraduate students' achievement in mathematics. This finding implicates Physics and Engineering teaching at University level in that the use of internet resources in the teaching of Physics and Engineering courses by the lecturers will lead to improved performance of students in Physics and Engineering since Mathematics is closely related to Physics and Engineering. Therefore, it can be concluded that the use of internet resources for learning Mathematics concepts significantly affect undergraduate students' academic achievement. As such, there is an urgent need for lecturers to engage students in the use of internet resources for learning Mathematics concepts. This could be made possible through the use of the electronic and computer-based methods in teaching Mathematics concepts.

## **RECOMMENDATIONS**

The following recommendations have been made based on the findings of the study

- Internet resources should be made adequately available in Nigeria Universities through collaborative efforts of the University authorities, government, and non-governmental organizations.
- Universities in a collaborative effort with Network providers and professional bodies should regularly organize seminars, workshops, and training of Mathematics educators as regards the effective use of internet resources.
- There should be orientation and re-orientation of mathematics students on the use of Internet resources for learning Mathematics concepts by authorities of educational institutions.
- Mathematics educators should engage students in computer-assisted instruction through video conferencing, use of e-mail, electronic library, and presentation software.

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