

## Teacher's perception of digital tools and resources utilization in secondary schools' STEM Education in Uyo Metropolis, Akwa Ibom State, Nigeria

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### Abstract

This study investigated teachers' perception of digital tools and resources utilization in secondary schools STEM education in Akwa Ibom State, Nigeria. The design of the study was a survey design with a sample size of 108 teachers obtained by simple random sampling technique. Teachers' perception of digital tools and resources utilization Questionnaire (TPDTRUQ) was used for data collection with a reliability of .89 using Cronbach Alpha statistics. Mean and standard deviation was used to answer the research questions. Findings showed that teachers' perception of digital tools and resources utilization was positive. Factors affecting digital tools and resources utilization were also identified... Based on the findings, it was concluded that teachers' perception of digital tools and resources was encouraging and promising. It was recommended among others that teachers should be encouraged by addressing the issue of accessibility of digital tools and resources by providing free or affordable data.

**Key words:** Teachers, perception, digital tools, digital resources, STEM Education

### Introduction

Science, Technology, Engineering and Mathematics (STEM) Education can be defined as the process of imparting scientific, technological, engineering, and mathematical knowledge, competencies, and skills that plays a crucial role in national development. The global standing and influence of a country in world affairs are contingent upon its progress in science and technology. STEM Education is not only engaging and stimulating but also essential for the practical application of scientific knowledge, serving as the foundational framework for effective national functioning.

STEM Education, comprises of core science disciplines such as chemistry, physics, and biology, along with technology, engineering, and mathematics. Instructions in STEM are delineated based on intellectual faculties and societal requirements. These objectives primarily include utilitarian, disciplinary, cultural, adjustment, social, international, vocational, educational preparation, and mental empowerment aims. In alignment with the objectives, specific objectives based on subject areas include knowledge and comprehension objectives,

skills objectives, application objectives, attitude objectives, and appreciation and interest objectives.

Failures in STEM Education at the secondary school level have been attributed to various factors such as ineffective instructional methodologies, the abstract nature of scientific concepts, negative student attitudes, inadequate teacher training, lack of qualified educators, and insufficient infrastructure and laboratory resources (Abbasi, Ibrahim & Ali, 2021; Akram, Yingxiu, Al-Adwan & Alkhalifah, 2021a; Adkins, 2020; Okwuduba, 2018). To enhance student knowledge, educators must adopt innovative teaching approaches and look beyond traditional classroom boundaries. The integration of emerging digital technologies in classrooms has facilitated personalized learning experiences tailored towards individual student needs, interests, and capabilities (Baddar & Khan, 2023).

In the realm of technology utilization in secondary schools, research by Ullah and Ali (2021) indicates disparities exacerbated by the COVID-19 pandemic, with students from elite urban private schools benefiting from online learning advantages

over their counterparts in rural public schools due to resource and teacher shortages. Despite the pandemic prompting the adoption of new technologies in education, full integration remains a work in progress (Ullah and Ali, 2021).

The term "digital" denotes any electronic device that generates, utilizes, or stores data in a binary code of 1s and 0s. Digital tools are web-based platforms or software applications harnessed by individuals or enterprises to execute tasks efficiently and promptly, which would otherwise be time-consuming. These tools include; computer hardware, software, networks, and multimedia devices like video, audio, phone, and camera, transforming data into text, sound, and motion (Eden *et al.*, 2023).

The integration of digital tools and emerging technologies encompasses various forms and dimensions, each fulfilling a distinct role. Notably, within the array of portable digital tools are Google Chromebooks and iPads, known for their adaptability to online and classroom settings. Additionally, other portable digital tools such as computers, clickers, SMART boards, and projectors are employed for disseminating information and facilitating teaching and learning activities. Leveraging computers as digital tools provides students with the opportunity to nurture and apply advanced cognitive skills to solve real-life challenges (Eden *et al.*, 2023). Educators now have access to a diverse range of digital tools and materials that enrich the teaching and learning environment (Rapanta *et al.*, 2020).

Digital resources encompass any form of information or media stored or transmitted in a digital form, such as on a computer or the internet (Eden *et al.*, 2023). These emerging digital resources comprise materials that are digitally conceived and produced or converted from analog to digital formats. As highlighted by Emelogu and Chigbu (2021), digital resources manifest as downloadable applications accessible through internet connectivity on various devices like computers, smartphones, tablets, netbooks, and e-books (Eden *et al.*, 2023). These resources include applications, software, programs, or websites which engage students in educational tasks and support their learning objectives such as video clips, audio recordings, music, blogs, websites, online forums, chat rooms, and search engines. Categorized into internet and offline resources, examples of internet resources are websites, blogs, forums, search engines, online libraries, and databases. On the other hand, offline digital resources comprise photos, videos, and audio recordings. The significance of digital resources in academic research is escalating, offering swift and convenient access to a plethora of information from diverse origins.

Baddar and Khan (2023) conducted a research focusing on the determinants of teachers' intention to incorporate digital resources in classroom instruction. Their findings indicated that teachers' intention to use digital tools is significantly impacted by their perceptions of competence, perceived usefulness and ease of technology utilization, and peer influence, with perceived competence exerting the most prominent influence among these factors. The study is grounded in Aslens' theory of planned behaviour (1985), a cognitive framework suggesting that behavioural success is influenced by both motivation (intention) and ability (behavioural control). This theory aims to elucidate behaviors that individuals can control. One key construct from this theory relevant to the study is perceived behavioural control, which pertains to an individual's perception of the ease or difficulty of engaging in a specific behaviour. This perception can vary based on circumstances, guiding teachers' attitudes towards integrating digital tools in STEM education.

Perception refers to an individual's comprehension and beliefs about a particular subject. In the context of this study, teacher perceptions entails their thoughts on the utilization of digital tools and resources. Teachers' perceptions can be shaped by various factors such as personal experiences, cultural background, and educational history. Teachers' beliefs significantly influence how they incorporate digital tools in instruction delivery to meet the evolving needs of education in the twenty-first century (Tondeur *et al.*, 2017).

Akram *et al.*, (2021); Akram *et al.*, (2022) explored teachers' perceptions of integrating digital tools in the teaching and learning process. Findings showed that teachers exhibit positive perceptions regarding technology integration, seeing it as a means to enhance instruction, engage students effectively, and maintain motivation. Conversely, Hassan (2021) identified challenges faced by faculty members in adopting ICT due to insufficient technological competencies. Other studies on the utilization of information communication technology for teaching-learning purposes enables teachers to stay connected with students and facilitates learning irrespective of their location and time (Hussain, 2018; Thaheem *et al.*, 2021). Teachers also feel comfortable guiding and discussing with their students within or outside the universities through several digital platforms such as What Sapp, Facebook, and google groups (Hodgson & Shah, 2017). Many teachers use non-digital teaching-learning resources like textbook, chalkboard, chart, map, globe, and models while teaching students. By knowing teachers' perceptions, this study would help teachers make the best use of

emerging technologies in teaching and learning activities In this regard, this study was intended to investigate teachers’ perceptions of digital tools and resources utilization in secondary schools’ STEM education.

**Research questions**

1. What is teachers’ perception of digital tools utilization in secondary schools in Uyo Metropolis?
2. What teacher’s perception of resources utilization in secondary schools in Uyo Metropolis?
3. What are the factors militating the effective use of digital tools and resources in secondary schools in Uyo Metropolis?

**Method**

The design adopted for this study was survey research design. The study was carried out in public secondary schools in Akwa Ibom State. The population of the study comprised of all the two hundred and seventy (270) STEM Education teachers (Physic, Chemistry, Biology, Mathematics, Basic Science and Technology) in the 15 secondary schools in Uyo metropolis of Akwa Ibom State. Simple random sampling technique was used to obtain one hundred and eight (108) senior secondary STEM Education teachers in 8 secondary schools in the study area. Researchers developed instrument,

“Teachers’ perception of digital tools and resources utilization Questionnaire (TPDTRUQ)” was used for data collection. It consisted of two sections: Section A, which contain respondents Bio-data while Section B contain items to determine teachers’ perception on digital tools, Section C consist of items on digital resources utilization and Section D factors militating against effective use of digital tools and resources. It consisted of ten- items each on digital tools and resources utilization and 5-items on factors militating the effective use of digital tools and resources with 4-point Likert scale of strongly agree-4points, agree-3points, disagree-2points, and strongly disagree-1point respectively. Instrument validation was done by three senior lecturers in the Departments of Science Education, Akwa Ibom State University. The reliability of the instrument was obtained by administering the instruments to 20 teachers in the area of study but not part of the sampled schools. A reliability coefficient of .89 was obtained using Cronbach Alpha statistics. This was adjourned reliable to be used for the study. The instrument was administered by the researchers and retrieved on the spot to ensure high return rate. Data obtained were analysed using descriptive statistics of mean and standard deviation to answer the research questions. Any item with mean response of 2.50 and above was considered positive while any mean response below 2.50 was considered negative.

**Result**

**Table 1: Mean and Standard deviation on teachers’ perception of digital tools utilization (N=108)**

S/N	Items	Mean	SD	Decision
<b>Teachers’ Perception of Digital Tools Utilization</b>				
1.	It assists teachers in enhancing their instructional practices in STEM education	2.96	0.71	Positive
2.	It increases interaction between teachers and students	2.51	0.81	Positive
3.	It motivate students to be more actively involved in learning activities	2.62	0.92	Positive
4.	It increases students’ academic achievements in STEM	2.45	0.99	Negative
5.	It enables students to understand more easily what they learn	2.47	0.96	Negative
6.	It makes choosing instructional materials for STEM teaching easier	2.73	0.99	Positive
7.	It builds courage in the teacher to deliver	2.68	0.98	Positive
8.	It makes teachers facilitators instead of information providers	3.40	0.64	Positive
9.	It encourages students to concentrate more on learning activities	2.96	0.28	Positive
10.	It makes teacher feel comfortable discussing with the students	3.02	0.79	Negative
<b>Aggregate</b>		<b>2.77</b>		



The result in Table 1 above showed that 8 items out of the 10 items had their mean ratings within the bench mark mean of 2.5 while items 4 and 5 had mean ratings below the bench mark of 2.50. This indicates that the teachers had positive perception of digital tools utilization in the teaching and learning in secondary schools STEM education in Uyo Metropolis with an aggregate mean of 2.77).

Hence, teachers' perception of digital tools utilization in secondary schools in Uyo Metropolis was positive. The standard deviation of all the items range from 0.28 to 0.99, which showed that the respondents were not too far from the mean and opinion of one another in their responses on their perception of digital tools utilization.

**Table 2: Mean and Standard deviation on teachers' perception of digital resources utilization (N=108)**

Teachers' Perception of Digital Resources Utilization		Mean	SD	Decision
11.	It makes my teaching better	2.68	0.78	Positive
12.	It encourages class interaction	3.22	0.75	Positive
13.	It allows the teacher to engage the students	3.31	0.73	Positive
14.	It helps to improve student teacher interaction	3.34	0.64	Positive
15.	It improves student completion of assignments	3.03	0.78	Positive
16.	It makes students not to copy notes	2.73	0.99	Positive
17.	It saves time	3.03	0.78	Positive
18.	It makes the lesson content delivery take longer	2.68	0.96	Positive
19.	They are easy to access	1.48	0.53	Negative
20.	It gives access to a wide range of information	3.31	0.73	Positive
<b>Aggregate</b>		<b>2.88</b>		

The result in Table 2 above showed that 9 items had their mean ratings ranging from 2.68 to 3.34 and were above the bench mark of 2.50 set for decision making. Except for item 19 which indicated a low mean of 1.48 which is below the bench mark. This indicates that the teachers had positive perception of digital resources utilization in the teaching and learning in secondary schools STEM

education in Uyo Metropolis (aggregate mean= 2.88). Hence, teachers' perception of digital resources utilization in secondary schools in Uyo Metropolis was positive. The standard deviation of all the items range from 0.53 to 0.99, which showed that the respondents were not too far from the mean and opinion of one another in their responses on their perception of digital resources utilization.

**Table 3: Mean and Standard deviation of factors militating the effective use of digital tools and resources (N=108)**

Factors' militating the effective use of Digital tools and Resources		Mean	SD	Decision
21.	Lack of good quality digital devices	3.31	0.73	Agree (2 <sup>nd</sup> )
22.	Economic factors	3.22	0.80	Agree (3 <sup>rd</sup> )
23.	Lack of power supply to use devices when available	2.68	1.00	Agree (5 <sup>th</sup> )
24.	Lack of access to digital resources (apps, blogs, videos etc)	3.34	0.64	Agree (1 <sup>st</sup> )
25.	Inability to manipulate digital technology	3.03	0.78	Agree (4 <sup>th</sup> )
<b>Aggregate</b>		<b>3.12</b>		

The result in Table 3 above showed that all items had their mean ratings ranging from 2.68 to 3.34 and were above the bench mark of 2.50. The table showed that the highest mean score of 3.34 represents the factor affecting teachers most which is lack of access to digital resources while the least mean score of 2.68 represents the least factor which is lack of power supply to utilize digital tools and resources. This indicates that the factors militating the use of digital tools and resources are eminent in

secondary schools STEM education in Uyo Metropolis (aggregate mean= 3.12). The standard deviation of all the items range from 0.73 to 1.00, which showed that the respondents were not too far from the mean and opinion of one another in their responses on the factors militating the use of digital tools resources.



## Discussion of Findings

The results of the study on teachers' perception of digital tools utilization in secondary schools in Uyo Metropolis showed that teachers had positive perception of digital tools utilization in the teaching and learning in secondary schools STEM education in Uyo Metropolis. This could be attributed to the notable availability of hand held devices owned by the teachers themselves. Many teachers are noticed to have android phones used in making and receiving calls, also used in taking pictures of persons and documents. This shows that teachers have access to digital tools like hand held devices but it is not yet clear if they actually utilize this devices to improve their content knowledge and lesson delivery. This agrees with Eden *et al.*, (2023) that the use of computers as digital tools offers students including teachers' an opportunity to cultivate and apply higher-level thinking skills to address problems that are pertinent to their daily lives

Findings on teacher's perception of resources utilization in secondary schools in Uyo Metropolis showed that teachers had positive perception of digital resources utilization in teaching and learning in secondary schools STEM education in Uyo Metropolis. It was observed that teachers agreed to the fact that for instance digital resources encourage class interaction but disagreed to the fact that it is easy to access digital resources. This could be attributed to the fact that although teachers have access to digital tools such as hand held devices and computer laptops, but they are expensive to purchase. They need to purchase expensive data to access many digital resources that are applications (apps), software, programs, or websites such as blogs, forums/ chat rooms, search engines, online libraries and databases. The findings of this study is in line with Akram *et al.*, (2021); Akram *et al.*, (2022) who found that teachers exhibit positive perceptions regarding technology integration in the teaching-learning process. They believe that digital tools and resources utilization in teaching assists teachers in enhancing the instructional process effectively, making the learning process exciting and interactive, and keeping learners motivated. This agrees with Baddar and Khan (2023) who found that factors that determine teachers' use of digital resources in classroom teaching is the intention to use digital resources in the classroom which was significantly influenced by teachers' perceptions of their own competence, perceived usefulness and ease of use of technology and digital resources, and peer influence. This therefore means that teachers' perception of digital resources utilization in secondary schools in Uyo Metropolis is

encouraging, however, efforts to provide for affordable data for teachers to access the internet remains a mirage. Hence, factors militating the use of digital tools and resources are lack of good quality digital tools, economic factors, lack of power supply, access and inability to manipulate tools and resources.

## Conclusion

Based on the findings that emanate from this study, it can be concluded that teachers' perception of digital tools and resources utilization in secondary schools in Uyo Metropolis was positive. The factors affecting the effective use of digital tools and resources include but not limited to lack of good quality digital tools, economic factors, lack of power supply, access and inability to manipulate tools and resources.

## Recommendations

Based on the findings of the study it was recommended that;

1. Teachers should engage more in the use of digital tools and resources. This would help teachers make the best use of emerging technologies in teaching and learning.
2. Teachers can assist in sorting out the challenges and assisting concerned authorities in formulating policies that incorporate digital tools and resources utilization.
3. Concerned authorities should endow all educational institutions with sufficient and emerging technologies for STEM education.
4. Opportunities should be created by the school authorities for teachers to share their experiences and best practices with digital tools and resources with one another so as to facilitate the establishment of social norms and encourage the integration of these tools and resources.

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