DISRUPTIVE TECHNOLOGY USE AND EDUCATION RESEARCH EFFICACY AMONG EARLY CAREER RESEARCHERS IN NIGERIAN UNIVERSITIES

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Abstract

The integration of disruptive technologies within higher education circles has kindled transformative shifts in teaching, learning, and research practices worldwide. With ever-evolving inventions aimed at improving research endeavors for timely and needed developments, the use of disruptive technology in research has become increasingly indispensable. This study investigates the use of disruptive technology among early career researchers and how it influences their education research efficacy. The study adopted the descriptive survey research design with three research questions formulated to guide it. The sample consisted of 604 early career researchers (221 Lecturer/Graduate Assistants, 207 Lecturer II and 176 Lecturer I). Stratified sampling technique was adopted geopolitical zone selection. A total of ten departments from seven faculties of education at five public universities were selected through the use of simple random sampling technique. Purposive sampling was also adopted to intentionally recruit early career researchers for this study. A well validated questionnaire on Disruptive Technology Use and Education Research Efficacy among Early Career Researchers in Nigerian Universities was used to elicit information from the respondents. The Cronbach Alpha Analysis yielded 0.76 reliability index. Frequencies and percentages

were statistical techniques employed to analyze the data. The findings of this study have significant implications for educational stakeholders, policymakers, and practitioners and this is intended to encourage further research on disruptive technology and its use in research within the Nigerian higher education ecosystem.
Keywords: Disruptive technology, research efficacy, early career teachers, faculties of education, Nigerian universities.

Introduction

Research in higher institutions has evolved as new and inventive technology is actively engaged in research., Researchers now create, collaborate, communicate, learn as well as acquire the necessary skills as demanded by their careers (Mikusa, 2015). These skills when mastered further help to build one's research capacity for greater innovation (Idika, Orji, & Idika, 2021), and subsequently enhance the researcher's efficacy. To improve research output, one needs to be abreast of evolving technologies (Idika, Orji, Bichene, & Oke, 2022; Owan, et al. 2023), use or engage same discretely in order to conform to the requirements of originality in research work and abide by defined ethics and scientific research standards in academia (Idika, & Ojini, 2019). The use of technology to improve research and education generally has advanced from mere information technology to disruptive technology which is further transforming the field of education research, offering new opportunities for literature search, instrumentation, data collection, analysis, and knowledge dissemination (Idika, Idaka, & Ukpor,2012).

Disruptive technologies according to Liu and Xue (2021), differ from other technologies and are often extremely destructive to traditional mainstream technologies. Flavin (2012) submits that disruptive technologies disrupt established practices, often starting with a small number of users, but growing over time to the extent that they displace a previously dominant, incumbent technology. Also, Washington (2019), explains that disruptive technologies occurs when a teacher uses a learning management system, adopts project-based learning to engage pupils, or develops individualized learning plans to teach financial literacy to low-income children. This is so because it disrupts a conventional process. Similarly, according to Dasgupta (2024), in order to improve teaching techniques, disruptive technology in education is important. With the greater shift to digital learning in the 2020s, the educational system has transcended geographic boundaries and now promotes a collaborative–learning environment. Observably, the emergence of disruptive technology has diversely impacted academia; Researchers or teachers, for instance, now have access to immense amounts of digital data and innovative research methods for greater behaviour prediction–which were previously inaccessible. Though these innovative methods are quickly adoptable, there are many disruptive technologies used for research purposes: e-learning platforms, big data analytics, chat-based /online collaboration tools, virtual and augmented reality, and artificial intelligence (Dasgupta, 2024).

Liu, & Xue (2021) suggest that to coordinate the work of researchers in the process of disruptive technological innovation, certain principles need to be established

to educate and guide scientific researchers and provide them with scientific principles. To them, research has to be focused, open minded, and action oriented It should be carried out with a developmental perspective, and must be controlled within a reasonable range as researchers need also to be exertive of their creativity. Of what essence could research results be if essential ingredients and relevant are lacking in the process? The importance of embracing technological advances in research and focusing this on early careers researchers cannot be overemphasized. Considering the efficacy of research among university teachers in the face of rapidly growing technology, particularly disruptive technology, is conceived by the authors as a brilliant decision towards moving research to the next levels. This is intended for rapid accomplishment of unique roles of innovative advancement and development in education and in other disciplines.

Christensen (1997) defines it as a new technology having lower cost and performance measured by traditional criteria, but having higher ancillary performance. He also posits, in his theory of disruptive innovation, that disruptive technology is not designed explicitly to support educational activities though it has education potentials. He further opines that these technologies bring to market a very different value proposition than had been available previously as products or services. Disruptive technologies, are typically cheaper, simpler, smaller, and more frequently convenient to use. Examples of disruptive technologies in education as highlighted earlier include; online learning platforms, artificial intelligence-driven personalized learning, virtual and augmented reality applications, data analytic tools for educational insights, and collaborative digital environments. With its effectiveness and an added efficiency, it is therefore, of little wonder why it is easily adopted by learners, teachers and researchers at large for ease of use and to further the course of efficient research and pedagogical development.

Disruptive technologies engagement in recent education ecosystem such as online resources, big data, virtual learning, and artificial intelligence cannot be denied as there are now extensively used to support teaching, learning, assessment and research (Suman, 2020; Owan, Abang, Idika, & Bassey, 2023). With this, it could become a bit easier for researchers to be able to connect with colleagues from anywhere, to make research more collaborative, effective and result oriented. Effectiveness and efficiency in research, when achieved satisfactorily could translate to research self-efficacy which for this paper would be referred to as research efficacy, a concept which has long been associated not only with expanding productivity (Eyong, & Orim, 2022) but also with the quality of expanding output of research investigations (Bassey, & Owan, 2019).

A person's belief about his or her ability to successfully perform and complete a given task or behavior in education is called educational efficacy. However, the ability to see, find and solve problems in education is generally called educational research efficacy (Dasgupta, 2024). People with high regard for their capability look for challenges to surmount and can sustain their efforts over difficult tasks (Delosa, Pagara & Manla, 2021). According to Taz, Demiral-Uzan, & Uzan (2023), researchers who belief in their own capability would influence their learning about research, engagement

and performance in doing research. Thus, relating to research, research self-efficacy is researchers' belief in their abilities to perform research-related tasks successfully (Forester, Kahn, & Hesson-Mclnnis, 2004). It can further be defined as a researcher's own judgment about the confidence in his/her own ability to successfully perform research-related tasks in a research process (Taz, Demiral-Uzan, & Uzan 2023). Education research efficacy can thus be defined as a sense of self-confidence possessed by a researcher to engage in research activities within the field of education. Research efficacy is shown to be positively related to researchers' productivity (Hemmings & Kay, 2016; Swank & Lambie, 2016) and faculty's job satisfaction (Ismayilova & Klassen, 2019). Lev, Kolassa & Bakken (2010) opine that efficacy in research plays a key role in predicting the success of one's research. Those with low research self-efficacy are not sure about their ability to perform research and do not believe that their attempt will lead to success. Those who are often anxious, especially when they are evaluated, feel a lack of competence (Tiyuri, Saberi, Miri, Shahrestanaki, Bayat, & Salehiniya, 2018). Concurrently, people with higher self-efficacy show more effort and insist on performing tasks than those with low self-efficacy. Hence, their performance in doing tasks is also better (Roshanian-ramin & Aqazadeh, 2013).

The use of disruptive technology in educational research has attracted considerable interest from a good number of research worldwide. Empirical evidences abound over the decades on building and increasing output and quality of research through technology use by young academics. For example, Idika, et al. (2012), Mikusa (2015), Haleem, et al. (2022), Bradford (2010), have shown that technology can serve as a means of achieving success in education and research. In higher education, studies have explored the relationship between /influence of technology use and/ or early career researchers / young lecturers' use of technology and variables such as self-efficacy (Denise, 2022); and self-concept (Emmanuel, Bolaji & James, 2023). Some researchers have also focused on how disruptive and other forms of technology including use of artificial intelligence (AI) apps, are used to enhance human resource efficacy and productivity (Diawati, et al., (2023); for academic writing (Malik, et al. 2023), and research measurements primarily by lecturers at the university (Owan, et al. 2023; Idika, et al., 2023). However, a gap still exists in the consistency of results and understanding, the extent of research efficacy and use of disruptive technology by beginning researchers at higher education level particularly at the universities, as well as how this use can influence their research efficacy towards increased productivity and innovation. It is for these reasons that this research was constituted to investigate disruptive technology use and its correlation with research efficacy among early career researchers in Nigerian universities. Understanding these dynamics is crucial for developing strategies that can empower early career researchers and consequently improve academic research landscape in the country.

Theoretical Framework

The theories adopted for this study are the Social Learning Theory by Albert Bandura of 1977 and the Technology Acceptance Model, initially proposed by Fred Davis in 1989. Social learning theory is based on the idea that we learn from our interactions with others in a social context. Separately, by observing the behaviors of others, people develop similar behaviors. After observing the behavior of others, people assimilate and imitate those very behaviors, especially if their observational experiences are positive ones or include rewards related to the observed behavior (Nabavi and Bijandi, 2023). According to Bandura (1977), learning would be exceedingly laborious, not to mention hazardous, if people had to rely solely on the effects of their own actions to inform them of what to do. In other words, people's actions are informed by behaviours they observe directly (through social interactions with others) or indirectly (through media); and as they observe~~,~~ actions that are rewarded they are more likely to be imitated.-Whereas those that are punished are avoided. The Bandura's social learning theory accounts fully for the interaction of environmental and cognitive elements that affect how people learn (Hammer, 2011).

Social learning theory stands relevant in this study because early career researchers can now observe and model the behavior of their senior colleagues who have effectively adopted disruptive technologies in their research. Observing others' positive experiences and outcomes can influence the likelihood of technology adoption. Also, collaborative efforts within the academic community can impact the adoption of disruptive technologies; particularly if mentors or collaborative groups promote and use these technologies, others may be more inclined to follow suit. This theory also stands relevant in research efficacy in the sense that higher self-efficacy in using disruptive technologies may lead to increased adoption among early career researchers as those who successfully integrate disruptive technologies into their research and showcase positive outcomes become models for others. This modeling can shape perceptions of the effectiveness of these technologies in research.

The Technology Acceptance Model (TAM) by Fred Davis (1989) explains the acceptance of information systems by individuals. TAM postulates that the acceptance of technology is predicated upon the users' behavioral intention, which is, in turn, determined by the perception of technology's usefulness in performing the task and the perceived ease of its use (Marikyan and Papagiannidis, 2023). According to Davis (1993), when users are presented with a new technology, three major factors influence their decision on how and when they will use it. The first determinant is its perceived usefulness (PU), the second is the perceived ease of use (PEOU), and the third determinant is user attitude towards usage (ATU). Early career researchers are likely to adopt disruptive technologies if they perceive them as useful in enhancing the quality, efficiency, or impact of their education research. Also, the ease with which early career researchers can incorporate disruptive technologies into their research processes will influence adoption. If these technologies are user-friendly and require minimal effort to integrate, adoption is more likely. TAM recognizes that external variables can influence the relationship between perceived ease of use, perceived usefulness, and intention to

use. For instance, external variables such as age, gender, academic rank and or experience may moderate the relationship between technology acceptance and research efficacy. This is, however, not within the scope of this paper.

Empirical Review

The level or extent of research efficacy of ECRs points to the degree to which this group of researchers can effectively conduct, produce and make meaningful research contributions within their disciplines. A reviewed report on the study carried out by Siddhpura, Indumathi, and Siddhpura (2020), centered on the current status of awareness of disruptive technology, but mostly in the area of engineering education. The research's future direction was also explored,—taking into account the emergence of new technologies like wearables, mobile computers, and the internet of things in conjunction with machine learning. The study shows the level of awareness and use of disruptive technology by early career researchers in engineering education to be significantly high and envisaged further increase in the near future.

In a related study carried out by Peilin (2017), disruptive technology enhances higher education research and learning. It uses interviews with Haaga-Helia University of Applied Sciences students, including business, IT, and tourism students, and multilingual assistants. The study finds that artificial intelligence tools are the latest disruptive technologies in research and learning. This study shows that the use of disruptive technology is high in all aspects of education.

The study carried out by Akujieze (2023) explores the relationship between self-efficacy and dedication among Nigerian university researchers. A questionnaire was distributed to 200 lecturers at federal and state colleges in Anambra State. Results showed a negative correlation between self-efficacy and dedication, with lower levels being associated with lower commitment. This research has implications for academic institutions. The result shows that the lecturers' research efficacy is low when measured with their level of job commitment.

The study called out by Bahaa, Bahaa, and Najma (2022) aimed to investigate application of artificial intelligence (AI) in higher education during times of crisis especially in the area of research, such as the Covid-19 pandemic. Top Arab universities were identified, and their performance were evaluated using web impact, research network, and international student ratio, among other indicators. Through the use of an online learning questionnaire, the study also investigated the customized AI applications utilized in these universities. Knowledge management, trust, learning, technological resources, and complexity are a few of the elements that have been shown to be crucial to improving AI in higher education. This study explained that disruptive technology which artificial intelligence is one of them, improves research efficacy among lecturers in any high institution.

` A closely equivalent study carried out by Edgar, Roberto Guillermo and Luis (2023), sought to address issues that obstruct research's potential, and investigated efficient ways to apply it to raise the standard of university education with the effect of

emerging technologies. Six subtopics were covered by the authors in their multivocal literature review: the value of interdisciplinary research and collaboration; the effect of research on instructional strategies and student outcomes; the potential of emerging technologies; the significance of diversity, equity and inclusion; the promotion of an innovative research culture; and the function of funding and resources. The revelations from the study have been found relevant to this study because emerging technologies like disruptive technologies improve research efficacy thereby improving the standard of research at the universities.

Statement of the Problem

The rapid evolution of disruptive technologies has initiated a paradigm shift in education and research across the globe and Nigerian universities are not excluded. Early career researchers are faced with the dual challenge of leveraging disruptive technologies to enhance their research efficacy while contending with unique challenges specific to the Nigerian higher education system which is characterized by a blend of tradition and modernity. Early career researchers are both beneficiaries and agents of change as they drive the integration of disruptive technologies while contending with inherent challenges such as limited access to viable resources, varying levels of technological proficiency, and institutional constraints. The integration of these technologies within the Nigerian higher education system, presents both opportunities and challenges, particularly for early career researchers, who are in the frontline of emerging knowledge creation and dissemination. While these technologies promise to revolutionize research practices and enhance scholarly collaboration, their successful integration requires a good understanding of the appropriate principles necessary to drive meaningful benefits in research. Despite widespread adoption of disruptive technologies in various sectors, there remains a notable research gap in understanding how these technologies impact research practices and education research efficacy of early career researchers in Nigerian higher education institutions. In the light of the foregoing, this study seeks to explore and to analyze disruptive technology knowledge levels and predominantly used tools that improve research efficacy among early career researchers in Nigerian universities.

Research questions

1. What is the extent of research efficacy among early career researchers?
2. To what extent or level is knowledge of disruptive technology tools used by early career researchers in Nigerian Universities?
3. What are the most predominantly used disruptive technology tools by early career researchers for improving research efficacy in Nigerian Universities?

Methodology

This study was centered on disruptive technology use and education research efficacy among early career researchers in Nigerian Universities. The study adopted the descriptive survey research design to answer two research questions which guided the

research. The sample consisted of 604 young university teachers drawn from three geopolitical zones of Nigeria. Stratified random sampling technique was adopted to pick the geopolitical zones being North-Central, South-South and South-West geopolitical zones of Nigeria. A total of five public universities and ten departments from seven faculties of Education were selected through the use of simple random sampling technique. Purposive sampling was also adopted to deliberately recruit early career researchers for this study. The instrument for data collection was a questionnaire tagged, "Disruptive Technology Use and Education Research Efficacy Questionnaire". The instrument was validated by three experts in measurement and evaluation. It was an agreement among researchers and experts that tools selected for listing on the questionnaire as items should reflect only those technologies that are applicable in Nigeria. This was also determined through the exploratory study as having 50% response and above by interviewees. They also suggested that tools to be investigated should be those used for educational research among early career researchers in Nigerian Universities. The questionnaire was in two sections; section A which covered the respondents' demographic data including; sex, age, highest level of education, name of institutions, department taught and rank in the institution; B section was made up of items that measured the level of knowledge and the most predominant disruptive technology tools used among early career researchers. Eleven tools or items that formed the common responses (50% and above test from exploratory interview in the study areas) were listed in each scale; these formed the two subscales measured on a four-point Likert scale. The reliability of the instrument was determined through the Cronbach alpha reliability analysis with coefficient of reliability as .76. Frequencies and percentages were employed to answer the research questions. Ethical considerations bothering on full consent and voluntary participation of the respondents were sought first before their participation in the study. Also, full anonymity of the participants that is, the identity of both the respondents and their responses being treated with full confidentiality, was obtained for the study. The questionnaire was administered to respondents in Universities of Abuja, Obafemi Awolowo University (OAU), Ekiti State University Ado Ekiti, University of Calabar and Cross River State University. The three-subregions presented two schools each; except for the north- central region where only University of Abuja was accessible for data collection at the time of this study.

Research question 1

What is the extent of research efficacy among early career researchers?

TABLE 1: Frequencies and percentage analysis of research efficacy among early career researchers

S/N	ITEMS	VHE (%)	HE (%)	LE (%)	VLE (%)
	Extent of research efficacy				
1	Bringing out Statement of problem for the study	511(84.60)	48 (7.95)	22 (3.64)	23 (3.81)
2	Formulating a research topic from a problem	127(21.03)	163(26.99)	311(51.49)	3 (0.49)

3	Can determine the variables to guide the study	304 (50.33)	184(30.46)	116(19.21)	0 (0)
6	Can state study hypothesis properly	441(73.01)	128 (21.19)	23(3.81)	12 (1.99)
7	Determination of the research design for any research study	91(15.07)	161(26.65)	329(54.47)	23(3.81)
8	Good knowledge of data collection	0(0)	203(33.61)	401(66.39)	0(0)
9	Determination of the statistical tool for any research study.	81(13.41)	192 (31.78)	8(0,01)	323 (53.47)
10	Publication skills on high index journal	4(0.67)	13 (2.15)	567(93.87)	20 (3.31)
11	Prefer publishing with local journals	551(91.23)	23 (3.81)	24(3.97)	6 (0.99)
12	Searching for publications to support my writing is very easy.	43(7.12)	7(1.16)	501 (82.95)	53(8.77)
13	Wide knowledge of research reporting	361(59.77)	117(19.37)	41(6.79)	85(14.07)

Key: very high extent (VHE), high extent (HE), Low extent (LE), and Very low extent (VLE)

Frequency and percentages were used to provide answers to research question one. The result is presented in Tables 1. Table 1 shows that a greater proportion of respondents (above 50 percent) indicate that they have very high level of research efficacy in the following areas: bringing out statement of problem, determine the variables, study hypothesis properly, prefer publishing with local journals and wide knowledge of research reporting. The result also showed that a large proportion of respondents (more than 50 percent) indicated that they have moderate and low extent of research efficacy in the following areas: formulating a research topic from a problem, determination of the statistical tools, publication skills on high index journal, good knowledge of data collection, determination of the research design for any research study and searching for publications to support my writing is very easy. This result implies that bringing out statement of problem, determine the variables, study hypothesis properly, prefer publishing with local journals and wide knowledge of research reporting, are the areas of research that early career researchers have very high efficacy in.

Research question 2

To what extent or level is knowledge of disruptive technology tools used by early career researchers in Nigerian Universities?

Frequency and percentages were used to provide answers to research question two. The result is presented in Table 2. Table 2 shows that a greater proportion of respondents (above 50percent) indicate that they have advanced knowledge in the following disruptive technology tools: Scientific Package for Social Science (SPSS), Google Doc, Mobile Technology, and Artificial Intelligence. The result also showed that a small proportion of respondents (more than 50 percent) indicated that they have intermediate and low level knowledge ~~on~~ in the following disruptive technology tools: Google Classroom, Cloud Computing, Chat Based Collaboration Tool, 3D printing and R. The result also showed that a very small proportion of respondents (more than 50

percent) indicated that they have no knowledge in the following disruptive technology tools: Virtual Augmented Reality, and Python. This result implies that SPSS, Artificial Intelligence, Google Doc and Mobile Technology, are widely known by early career researchers and are aimed to improve research efficacy in research in Nigerian Universities.

TABLE 2 : Frequencies and percentage analysis of knowledge of disruptive technology tools among early career researchers.

S/N	ITEMS	AK (%)	IK(%)	LK(%)	NK(%)
	Disruptive Technology Tools				
1	Artificial Intelligence	541(89.56)	37(6.13)	6(0.99)	20(3.32)
2	3D Printing	6(0.99)	131(21.69)	410(67.88)	57(9.44)
3	Mobile Technology	511(84.60)	69(11.42)	22(3.65)	2(0.33)
4	Google Doc	592(98.01)	8(1.33)	4(0,66)	0(0)
5	Google Classroom	19(3.15)	77(12.75)	501(82.95)	7(1.15)
6	Virtual Augmented **R**eality	0(0)	2(0.33)	131(21,69)	471(77.98)
7	Cloud Computing	10(1.66)	439(72.68)	91(15.07)	64(10.59)
8	R	3(0.50)	177(29.30)	419(69,37)	5(0.83)
9	Python	1(0.17)	3(0.50)	3(0.50)	597(98.83)
10	Scientific Package for Social Sciences (SPSS)	458(75.82)	77(12.75)	19(3.15)	50(8.28)
11	Chat -Base Collaboration Tool	1(0.17)	471(77.97)	110(18.21)	22(3.65)

Key: Advanced knowledge (AK), Intermediate knowledge (IK), Low knowledge (LK), No knowledge (NO).

Research Question 3

What are the most predominantly used disruptive technology tools by early career researchers for improving research efficacy in Nigerian Universities?

Frequencies and percentages were also used to analyze the collected data. The same Table 2 that was used for research question 2 is also used here. Table 2 shows that a greater proportion of respondents (above 50 percent) indicate that the following disruptive technology tools are used always: SPSS, Google Doc, Mobile Technology, and Artificial Intelligence. The result also showed that a small proportion of respondents (more than 50 percent) indicated that the following disruptive technology tools are used sometimes: Google Classroom, and Cloud Computing, The result also showed that a

small proportion of respondents (more than 50 percent) indicated that the following disruptive technology tools are rarely used: Chat base Collaboration Tool, 3D printing and R. The result also showed that a very small proportion of respondents (more than 50 percent) indicated that the following disruptive technology tools had never been used: Virtual Augmented Reality, and Python. This result implies that SPSS, Artificial Intelligence, Google Doc and Mobile Technology, are predominantly used by early career researchers in Nigerian Universities with the aim of improving research efficacy of this group of teachers.

Discussion of findings

To examine the level of knowledge and the most predominantly used disruptive technology tools that aim to improve research efficacy among early career researchers in Nigerian universities, the study employed descriptive statistics (frequencies and percentages) in order to analyze the data.

Research questions were formulated to ascertain the extent or the level of knowledge of disruptive technology tools used by early career researchers in Nigerian Universities. The findings indicate that SPSS, Artificial Intelligence, Google Doc and Mobile Technology, are widely known by early career researchers in education research in Nigerian Universities. This is aimed at improving research efficacy. This is also possible because disruptive technologies, which the respondents have associated with advanced knowledge, have earlier been identified as having user friendly interface (Owan et al, 2023; Idika et al, 2023). A good number of researchers and others are fast getting to understand the need and relevance of disruptive technology tools. The advance knowledge of SPSS, Artificial Intelligence, Google Doc and Mobile Technology, and research efficacy reflects recognition of the diverse needs and preferences of early career researchers. It suggests an acknowledgment of the importance of providing a variety of technologies to accommodate different research efficacies. The emphasis on artificial intelligence and research efficacy indicates a shift towards more robust application and real-world relevance in research. This aligns with the dynamic nature of research diversity endeavors that require hands-on experience and skill development. The incorporation of SPSS package and mobile technology suggests a reliance on technology to enhance educational research experience. This aligns with contemporary trends of leveraging technology to facilitate flexible research efficacy and cater for early the individual needs of early career researchers. The result agrees with the findings of Siddhpura, Indumathi, and Siddhpura, (2020) on the current status of awareness of disruptive technology, mostly in the area of engineering education. The study shows the level of awareness and use of disruptive technologies by early career researchers in engineering education was significantly high and will increase in the near future.

What are the most predominantly used disruptive technology tools by early career researchers for education research in improving research efficacy in Nigerian Universities? The finding of research question two indicates that SPSS, artificial intelligence, Google Doc and mobile technology, are the most predominantly used

disruptive technology tools by early career researchers in education research in Nigerian Universities. This is aimed ~~to~~ at improving research efficacy. This result justifies the reason why SPSS, artificial intelligence, Google Doc and mobile technology~~,~~ are free access disruptive technologies. This means that it is free. Therefore, flexibility of these tools is what makes ~~it~~ them the most predominately used disruptive technology tools for research purpose. The inclusion of Google Doc as a disruptive technology tool highlights the value of real-world insights and experiences. Google Doc can offer early career researchers a direct connection to the research community, providing inspiration, industry knowledge, and practical advice. Educational institutions should actively seek opportunities to bring successful educational researchers who have high level of research efficacy into the school system. This fosters networking and mentorship opportunities for early career researchers. The use of technology in educational research underscores the role of digital tools like mobile technology, artificial intelligence and SPSS in preparing early career researchers for modern research landscapes. Integrating technology into research writing, data collection, data analysis and interpretation allows early career researchers to familiarize themselves with digital research practices, online access to materials, and e-method of data collection and analysis which invariably improves research efficacy. Universities should ensure access to relevant technologies and make them easily accessible to early career researchers in other to keep pace with industry trends. The result agrees with the findings of Peilin~~,~~ (2017)~~,~~ reasoned that disruptive technology use is enhancing higher education learning and research. The study finds that artificial artificial intelligence is the latest disruptive technology in research and learning. This study also shows that the use of disruptive technology is high in all aspect of education

Conclusion and Recommendations

To examine the level of knowledge and the most predominantly used disruptive technology tools that aim to improve research efficacy among early career researchers in Nigerian universities, the study employed descriptive statistics (frequency and percentages) in order to analyses the data. The findings showed that the level of knowledge and the most predominately used disruptive technology tools are: SPSS, artificial intelligence, internet and mobile technology~~.~~ These are used by early career researchers in education research in Nigerian Universities in improving research efficacy. In conclusion, increasing disruptive technology tools-use for improved research efficacy among early career researchers~~,~~ should be the concern of all stakeholders of the university management and administration~~.~~ Greater effort should be put ~~to~~ in encouraging them and in motivating their academic progression~~.~~ Motivating all early career researchers to embrace disruptive technology and other forms of technology could enhance the needed transformation in education research, and other subsectors in Nigeria. Based on the findings of the study, the following are recommended;

1. Adequate effort by university administrators~~,~~ and all stakeholders to ensure sustenance of research efficacy among the early career researchers~~.~~

2. University managers and administrators to ensure adequate facilities particularly the latest technological tools with personnel to offer periodic training in order to boost research efficacy and productivity among early career researchers.
3. Efforts to motivate early career researchers with special training programs at departmental, and faculty levels as well as inter-institutional training engagements, to boost their research efficacy.
4. Nigerian university administrators should increase the frequency of the research leave given to the lower ranked faculty members as a means of encouraging them to upgrade themselves.

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