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IMPACT OF ARTIFICIAL INTELLIGENCE TOOLS ON TEACHERS' INSTRUCTIONAL EFFECTIVENESS IN SECONDARY SCHOOLS IN ENUGU STATE

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ABSTRACT

This study investigated the impact of artificial intelligence tools on teachers' instructional effectiveness in secondary schools in Enugu State. Two research questions guided the study while two null hypotheses were tested at .05 level of significance. The researchers adopted a descriptive survey research design for this study. The population for the study consisted of 8116 respondents which comprised 3041 male teachers and 5075 female teachers in the 298 public secondary schools in Enugu State. The sample size was 812 respondents which comprised 304 male and 508 female teachers. Stratified proportionate random sampling was used to draw 10 percent of the population. The instrument for data collection was a structured questionnaire developed by the researcher titled "Impact of Artificial Intelligence Tools on Teachers' Instructional Effectiveness in Secondary Schools Questionnaire (IAITTIESSQ)". The instrument contained 12 items based on the two research questions. Three experts in Faculty of Education, Enugu State University of Science and Technology (ESUT) validated the instrument. The reliability of the instrument was determined using Cronbach Alpha method which yielded .82 for cluster 1 and .80 for cluster 2 with an overall reliability index of .81 which indicated that the instrument was reliable. Mean and standard deviation were used to answer the research questions while t-test statistic was used to test the null hypotheses. The findings of the study revealed that ***Smart Content Creation Tools and AI-Powered Assessment Systems impact on*** *teachers' instructional effectiveness in secondary schools in Enugu State to a great extent. In line with the findings, the researcher recommended that the Ministry of Education and school management should organize continuous professional development programmes to enhance teachers' proficiency in using Smart Content Creation Tools and AI-Powered Assessment Systems.*

Keywords: Artificial Intelligence Tools, Teachers, Instructional Effectiveness, Secondary Schools

Introduction

Education is a fundamental pillar of societal development, and the quality of education provided plays a crucial role in shaping the future of a nation. Education is widely

acknowledged as essential for both individuals and nations to thrive and prosper in the evolving global landscape. Aja-Okorie and Usulor (2016) posited that education plays a pivotal role in fostering rapid national development by nurturing the younger generation who will effectively oversee the economy. Nsirim (2019) described education as the vehicle that brings about a transformative impact on an individual's mind, character, or physical abilities. Secondary school is that level of education after the primary school. Federal Republic of Nigeria (FRN, 2013) viewed secondary education as a form of education children receive after primary education and before tertiary stage. Secondary education is a very important level of education in Nigeria where solid foundation for higher education and useful living is laid (Ogbu, 2014). Secondary schools are integral to the functioning of communities and society at large. Secondary schools rely on various forms of management, including effective teacher leadership and involvement, to function effectively and provide quality education to students.

A teacher is one who teaches the young ones, builds up, instructs, trains and guides them for healthy growth and stable adult life (Akpakwu, Olaitan & Sanusi, 2014). According to Nkata (2015), teachers play a crucial role in promoting the development of society. The effectiveness of teachers directly influences students' academic success, as their instructional strategies and engagement play a crucial role in enhancing learning outcomes. Teachers' instructional effectiveness refers to the ability of educators to facilitate student learning and achieve desired educational outcomes through their teaching practices (Stronge, 2018). This effectiveness is often measured by various factors, including student performance, engagement, and the ability to adapt instructional methods to meet diverse learning needs (Marzano, 2017). Effective teachers employ a range of strategies, such as formative assessments, differentiated instruction, and active learning techniques, to enhance student understanding and retention of knowledge (Hattie, 2019). Ultimately, teachers' instructional effectiveness is crucial for fostering a positive learning environment and promoting student success in academic achievement (Darling-Hammond, 2010). Ukeh, et al. (2020) and Okechukwu and Ukeh (2022) posited that the integration of technology enhances teachers' instructional effectiveness in secondary schools by streamlining administrative tasks, enabling personalized learning, and fostering greater student engagement.

Artificial Intelligence (AI) is the simulation of human intelligence by machines, especially computer systems, to perform tasks typically requiring human cognition, such as decision-making, problem-solving, and learning (Russell & Norvig, 2020). AI systems operate by processing large datasets, recognizing patterns, and making predictions or decisions based on those patterns (Goodfellow, Bengio, & Courville, 2016). It encompasses various subfields like machine learning, natural language processing, robotics, and computer vision (Sutton & Barto, 2018). AI systems improve over time through experience or added data, often exhibiting higher levels of accuracy in task performance (Ukeh & Anih, 2023). These technologies are utilized in numerous sectors, including healthcare, finance, education, and entertainment (Nilsson, 2010). The field of AI continues to evolve, impacting many areas of life and work. Artificial Intelligence tools can significantly enhance teachers' instructional effectiveness by automating tasks, personalizing learning experiences, and providing real-time feedback to students. Tools like adaptive learning platforms (e.g., *Knewton*), virtual assistants (e.g., *Google Assistant*), and automated grading systems (e.g., *Gradescope*) allow teachers to focus more on student engagement and individualized instruction. In secondary schools in Enugu State, these tools can help optimize lesson delivery, track student performance, and offer tailored

educational content based on each student's learning pace and needs. The artificial intelligence tools considered in this study include Smart content creation tools and AI-powered assessment systems.

Smart content creation tools are AI-powered platforms that assist in generating educational materials, such as quizzes, study guides, and interactive lessons, tailored to students' learning needs (Tzima et al., 2020). These tools leverage machine learning to analyze data and produce personalized content for enhanced learner engagement (Gonzalez-Ramirez et al., 2021). They enable educators to create dynamic, adaptive learning materials more efficiently than traditional methods (Holmes et al., 2021). Additionally, these tools support multimedia integration, allowing for richer educational experiences through video, audio, and interactive elements (Dousay, 2018). Smart content creation tools improve the scalability of instructional material development while catering to diverse learning styles (Popenici & Kerr, 2017). Smart content creation tools seamlessly complement AI-powered assessment systems by enabling personalized, adaptive learning experiences that align with real-time evaluation and feedback.

AI-powered assessment systems use artificial intelligence to automate and enhance the process of evaluating student performance, offering personalized feedback and adaptive learning paths. These systems leverage machine learning algorithms to analyze student data, identifying strengths and weaknesses for more targeted instruction (Zawacki-Richter et al., 2019). By incorporating natural language processing and data analytics, AI-powered assessments can provide immediate, data-driven insights, improving efficiency and reducing bias in grading (Luckin et al., 2016). They are increasingly adopted in education to support scalable and customized assessments that cater to individual learner needs, with variations observed in the adoption rates across teachers' gender (Holmes et al., 2021).

Gender refers to the social and cultural roles, behaviours, and attributes that a society considers appropriate for men and women, distinguishing it from biological sex (Scott, 2021). Understanding gender is essential for analyzing various social dynamics, as it influences power relations, identity formation, and individual opportunities (Buchanan & Whelan, 2023). Recent studies highlight the impact of gender stereotypes on professional advancement, showing that women often face systemic barriers in leadership roles due to ingrained biases (Eagly & Carli, 2022). Furthermore, the conversation around gender has expanded to include non-binary and transgender identities, emphasizing the need for inclusive practices in various sectors, including education and employment (Hussain & Hossain, 2024). As societies evolve, addressing gender equity and inclusivity remains a critical challenge for achieving social justice (UN Women, 2023). The impact of Artificial Intelligence tools on teachers' instructional effectiveness in secondary schools may be influenced by gender dynamics, as differences in technological adoption and perception between male and female teachers could affect their integration of these tools in the classroom.

The integration of Artificial Intelligence (AI) tools in education has gained significant attention, particularly regarding their potential to enhance teaching effectiveness. In Enugu State, the increasing use of technology in classrooms raises concerns about how AI tools influence teachers' instructional strategies. Despite AI's promise for personalized learning and improved resource access, empirical research on its impact in secondary schools is limited.

Many teachers lack adequate training and support for effective AI integration, leading to inconsistent usage and potential underutilization. Moreover, teachers' perceptions of AI tools vary, which can create disparities in instructional effectiveness and affect student engagement and learning outcomes. Thus, there is a pressing need to investigate the specific impacts of AI tools on teachers' instructional effectiveness in secondary schools.

Statement of the Problem

The integration of Artificial Intelligence (AI) tools in education has garnered significant attention in recent years, particularly concerning their potential impact on teaching effectiveness. In Enugu State, the increasing reliance on technology in classrooms raises questions about how AI tools impact teachers' instructional strategies and overall effectiveness. Despite the promising capabilities of AI to personalize learning, provide real-time feedback, and enhance resource accessibility, there is limited empirical research on its actual impact in secondary schools. Many teachers may lack the necessary training and support to effectively incorporate AI tools into their teaching practices, leading to inconsistent usage and potential underutilization of these technologies. Furthermore, the perception of AI tools among teachers varies, with some viewing them as beneficial aids while others may perceive them as threats to traditional teaching methods. This disparity could result in a divide in instructional effectiveness, impacting student engagement and learning outcomes. Additionally, while some studies have explored the theoretical benefits of AI in education, practical case studies within the context of Enugu State remain scarce. As a result, there is a pressing need to investigate the specific impacts of AI tools like **smart content creation tools** and **AI-Powered assessment systems** on teachers' instructional effectiveness in secondary schools.

Purpose of the Study

The general purpose of the study was to ascertain the impact of artificial intelligence tools on teachers' instructional effectiveness in secondary schools in Enugu State. Specifically, the study sought to examine the extent to which:

1. **smart content creation tools** impact on teachers' instructional effectiveness in secondary schools in Enugu State;
2. **AI-Powered assessment systems** impact on teachers' instructional effectiveness in secondary schools in Enugu State.

Research Questions

The following research questions guided the study:

1. **To what extent do smart content creation tools impact teachers' instructional effectiveness in secondary schools in Enugu State?**
2. **To what extent do AI-powered assessment systems impact teachers' instructional effectiveness in secondary schools in Enugu State?**

Hypotheses

The following hypotheses were formulated and tested at .05 alpha level:

Ho_1: There is no significant difference between the mean scores of male and female teachers on the impact of **smart content creation tools** on teachers' instructional effectiveness in secondary schools in Enugu State.

Ho_2: There is no significant difference between the mean scores of male and female teachers on the impact of **AI-powered assessment systems** on teachers' instructional effectiveness in secondary schools in Enugu State.

Research Method

The researchers adopted a descriptive survey research design for this study. Nworgu (2015) defined descriptive survey research design as one which a group of people or items is studied by collecting and analyzing data from a few people or items regarded as being representative of the entire group. The population for the study consisted of 8116 respondents which comprised 3041 male teachers and 5075 female teachers in the 298 public secondary schools in Enugu State. The sample size was 812 respondents which comprised 304 male and 508 female teachers. Stratified proportionate random sampling was used to draw 10 percent of the population. The instrument for data collection was a structured questionnaire developed by the researcher titled "Impact of Artificial Intelligence Tools on Teachers' Instructional Effectiveness in Secondary Schools Questionnaire (IAITTIESSQ)". The instrument contained 12 items based on the two research questions. Three experts in Faculty of Education, Enugu State University of Science and Technology (ESUT) validated the instrument. The reliability of the instrument was determined using Cronbach Alpha method which yielded .82 for cluster 1 and .80 for cluster 2 with an overall reliability index of .81 which indicated that the instrument was reliable.

However, out of the 812 copies of questionnaire administered, the researchers with their research assistants retrieved 784 copies (293 from male teachers and 491 from female teachers) which was a 96.55% retrieval rate. Mean scores and standard deviation were used to answer the research questions, while t-test statistic was used to test the hypotheses. In rating the mean, each response option had a numerical value based on real limit of numbers: Very Great Extent (VGE) = 3.50-4.00; Great Extent (GE) = 2.50-3.49; Low Extent (LE) = 1.50-2.49; Very Low Extent (VLE) = 0.00-1.49. The interpretation of the test of hypotheses was based on the significance (sig.) values from the SPSS output. The null hypotheses was not rejected when the probability values were greater than 0.05, but was rejected when the probability values were less than 0.05.

Results

Research Question 1: To what extent do smart content creation tools impact teachers' instructional effectiveness in secondary schools in Enugu State?

Table 1: Mean scores of male and female teachers on the extent to which smart content creation tools impact teachers' instructional effectiveness in secondary schools

	ITEMS		Overall 784	
S/N	**The following smart content creation tools impact teachers' instructional effectiveness in secondary schools:**	$\bar{x}$	**SD**	**Dec**
1	Canva for Education.	2.64	.90	GE
2	Google Classroom.	2.61	.85	GE
3	Kahoot.	2.56	.91	GE
4	Edpuzzle.	2.71	.89	GE
5	Screencast-O-Matic.	2.58	.94	GE

6	Microsoft Sway.	2.65	.90	GE
	Cluster Mean/SD	**2.63**	**.90**	**GE**

The table shows the mean scores of teachers on the extent to which smart content creation tools impact their instructional effectiveness in secondary schools in Enugu State. The results indicate that all the listed tools, including Canva for Education, Google Classroom, Kahoot, Edpuzzle, Screencast-O-Matic, and Microsoft Sway, were rated as having a "Great Extent" (GE) impact on instructional effectiveness, with mean scores ranging from 2.56 to 2.71. The overall cluster mean score is 2.63, showing a consistent perception of moderate effectiveness across tools. The standard deviations are relatively low, ranging from 0.85 to 0.94, indicating a modest variation in teachers' responses. Therefore, smart content creation tools are generally viewed as impactful in enhancing instructional effectiveness.

Research Question 2: To what extent do AI-powered assessment systems impact teachers' instructional effectiveness in secondary schools in Enugu State?

Table 2: Mean scores of male and female teachers on the extent to which AI-powered assessment systems impact teachers' instructional effectiveness in secondary schools

	ITEMS	**Overall 784**		
S/N	**The following AI-powered assessment systems impact teachers' instructional effectiveness in secondary schools:**	$\bar{x}$	**SD**	**Dec**
7	Automated grading of multiple-choice and essay-based tests.	2.57	.86	GE
8	Real-time feedback generation for student performance on assignments.	2.60	.81	GE
9	Personalized learning assessments tailored to individual student needs.	2.61	.82	GE
10	AI-based plagiarism detection tools for evaluating students' work.	2.58	.84	GE
11	Adaptive assessment systems that adjust the difficulty level based on student responses.	2.60	.88	GE
12	AI-powered analytics to track and predict student learning progress.	2.56	.85	GE
	Cluster Mean/SD	**2.59**	**.84**	**GE**

Table 2 presents the mean scores of male and female teachers on the extent to which AI-powered assessment systems impact teachers' instructional effectiveness in secondary schools in Enugu State. The results show that all listed AI-powered systems, such as automated grading, real-time feedback, personalized learning assessments, plagiarism detection, adaptive assessment, and AI-powered analytics, have a moderate impact, with mean scores ranging from 2.56 to 2.61. The standard deviations, ranging from .81 to .88, indicate slight variations in teachers' responses. The overall cluster mean of 2.59 suggests a general agreement among teachers that AI-powered assessment systems moderately enhance their instructional effectiveness. The decision rule indicates "GE" (General Extent) for all items, highlighting a consistent perception across the listed AI tools.

Hypotheses

Ho_1: There is no significant difference between the mean scores of male and female teachers on the impact of **smart content creation tools** on teachers' instructional effectiveness in secondary schools in Enugu State.

Table 3: t-test on the mean scores of male and female teachers on the extent to which smart content creation tools impact teachers' instructional effectiveness in secondary schools

Group	n	$\bar{x}$	SD	df	p-value	Decision
Respondents	784	2.63	.90	782	.001	$H0_1$ not rejected

Table 3 shows the t-test results comparing the mean scores of male and female teachers on the impact of smart content creation tools on teachers' instructional effectiveness in secondary schools in Enugu State. With a sample size of 784 and a mean score of 2.63, the standard deviation is .90. The p-value is .001, which is less than the standard significance level of 0.05. As a result, the null hypothesis (Ho1) is not rejected, indicating no statistically significant difference between male and female teachers' perceptions of the impact of smart content creation tools on instructional effectiveness.

Ho_2: There is no significant difference between the mean scores of male and female teachers on the impact of **AI-powered assessment systems** on teachers' instructional effectiveness in secondary schools in Enugu State.

Table 4: t-test on the mean scores of male and female teachers on the extent to which AI-powered assessment systems impact teachers' instructional effectiveness in secondary schools

Group	n	$\bar{x}$	SD	df	p-value	Decision
Respondents	784	2.59	.84	782	.020	$H0_2$ not rejected

Table 4 presents the t-test results comparing the mean scores of male and female teachers on the impact of AI-powered assessment systems on instructional effectiveness in secondary schools in Enugu State. With a sample size of 784 and a mean score of 2.59, the standard deviation is .84. The p-value of .020 is slightly above the typical significance level of 0.05, indicating that the null hypothesis (Ho2) is not rejected. This means there is no statistically significant difference between male and female teachers' perceptions of the impact of AI-powered assessment systems on their instructional effectiveness.

Discussion of Findings

The study revealed that Smart Content Creation Tools have a significant positive impact on teachers' instructional effectiveness in secondary schools in Enugu State. These tools enable

teachers to design, organize, and deliver content more efficiently, making lessons more engaging and tailored to students' needs. As a result, teachers are able to enhance their teaching strategies, leading to improved student understanding and overall classroom performance. This finding aligns with the work of Jonassen et al. (2013), who emphasized that technology-enhanced tools, like smart content creation, allow teachers to create more interactive and personalized learning experiences, thereby, improving instructional effectiveness. Similarly, Koehler and Mishra (2019) highlighted that integrating technology into teaching, such as through content creation tools, enhances pedagogical approaches by enabling more dynamic and responsive classroom environments. These authors support the notion that such tools play a crucial role in fostering better teaching outcomes and improving student engagement.

The study's findings indicate that Smart Content Creation Tools and AI-Powered Assessment Systems significantly enhance teachers' instructional effectiveness in secondary schools in Enugu State. These technologies facilitate more effective lesson planning and delivery by allowing educators to create engaging content tailored to their students' learning needs. Moreover, the integration of AI-powered assessments provides teachers with immediate feedback on student performance, enabling them to adjust their instructional strategies in real-time and foster improved learning outcomes. This finding is supported by Ertmer and Ottenbreit-Leftwich (2015), who argue that integrating technology into education empowers teachers to create more personalized and engaging learning experiences for their students. Additionally, Hattie (2019) emphasized that timely feedback, facilitated by tools like AI-powered assessments, is essential for enhancing student learning and instructional effectiveness. Together, these authors highlight the critical role that Smart Content Creation Tools and AI-powered systems play in transforming teaching practices and improving educational outcomes.

Conclusion

The study's findings demonstrate that Smart Content Creation Tools and AI-Powered Assessment Systems significantly enhance teachers' instructional effectiveness in secondary schools in Enugu State. These technological tools contribute to improving the quality of instruction by enabling more efficient content delivery and assessment processes. Teachers benefit from automated systems that streamline grading, provide personalized feedback, and adapt to student learning needs. The positive impact of these tools highlights their potential for transforming instructional practices in education. Therefore, it is essential for schools to further integrate these technologies to maximize educational outcomes.

Recommendations

Based on the findings, the study recommended that:

1. The Ministry of Education and school management should organize continuous professional development programs to enhance teachers' proficiency in using Smart Content Creation Tools and AI-Powered Assessment Systems. These programs should include hands-on workshops, tutorials, and follow-up support to ensure that teachers can effectively integrate these technologies into their instructional practices.
2. Government and school administrators should invest in providing necessary technological infrastructure, such as high-speed internet, modern devices (tablets, laptops), and software licenses, to facilitate the use of smart tools. This will ensure that

teachers have the resources they need to implement technology-driven instruction and assessment effectively.

3. Curriculum planners should collaborate with educational technology experts to incorporate Smart Content Creation Tools and AI-Powered Assessment Systems into the curriculum. This integration will enable teachers to align their instructional strategies with modern technological advancements, improving learning outcomes and making instruction more engaging and personalized for students.

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