



Effects of Artificial Intelligence on Cognitive Domain of Tertiary Institutions Students in Rivers State, Nigeria

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Abstract

This study investigated the effects of artificial intelligence (AI) on the cognitive domain of tertiary institutions students in Rivers State, Nigeria, aiming to assess AI tools' usage, impact on cognitive skills and learning outcomes, and identify challenges and opportunities of AI adoption. Employing a survey research design, the study collected data from 1500 respondents (students and lecturers) across Rivers State's tertiary institutions using a structured questionnaire. Findings revealed significant AI integration, enhancing personalized learning, cognitive skills like analytical thinking and problem-solving, and learning outcomes. AI's management of cognitive load and scaffolding of learning aligned with cognitive load theory and constructivist learning theory. Challenges included infrastructure limitations, training needs, equity concerns, and data privacy risks, while opportunities encompassed enhanced personalization, efficiency, innovative learning tools, and future-ready skills. The study concluded that AI has potential in transforming Rivers State's tertiary institutions students' education, emphasizing careful implementation and strategic investments thus recommended that government should invest in AI infrastructure, teacher training, addressing equity and access concerns, enhancing data security, promoting personalized learning, monitoring AI impact and ethics, and engage educational stakeholders for effective AI integration in tertiary institutions in Rivers State.

Keywords: Artificial Intelligence (AI), Cognitive Domain, Rivers State, Tertiary Institutions.

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Introduction

The integration of Artificial Intelligence (AI) has become a transformative trend globally in education, particularly in tertiary institutions. AI impacts students' cognitive domains—including knowledge acquisition, comprehension, and evaluation—with tools such as adaptive learning systems and AI-based tutoring, which aim to personalize learning and improve outcomes. However, the adoption of AI in Rivers State, Nigeria, raises important questions about its impact on cognitive processes, student autonomy, and the nature of assessment.

Therefore, this study aims to specifically investigate the effects of AI on the cognitive domains of tertiary students in Rivers State, Nigeria. Specifically, this study has three objectives: (1) to assess the level of use and integration of AI tools in tertiary institutions in Rivers State; (2) to evaluate the impact of AI on students' cognitive skills and learning outcomes; and (3) to identify challenges and opportunities in adopting AI in the region (Adewale et al., 2024; Mohamed et al., 2025; Haetami, 2025). These objectives are supported by cognitive load theory, which posits that AI can manage students' mental load through personalization, and constructivist learning theory, which views AI as a scaffolding tool that supports students in their zone of proximal development.

Although literature reviews indicate that AI has the potential to improve learning, educational management, and academic outcomes globally (Aksel Stenberdt & Makransky, 2023; Guan et al., 2022) and offers opportunities for Nigeria Garzón et al. (2025); Mustafa et al. (2024) its adoption faces challenges in terms of infrastructure and training needs (Du Plooy et al., 2024); (Vieriu & Petrea, 2025); (Rahiman & Kodikal, 2024). A gap in the research is the lack of understanding of the specific effects of AI on cognitive skill development in the context of higher education institutions in Rivers State, Nigeria. By addressing this gap, this study aims to provide valuable insights for stakeholders to leverage AI to enhance cognitive development in higher education.

Methodology

This study employed a survey research design to investigate the effects of artificial intelligence on the cognitive domain of tertiary institutions students in Rivers State, Nigeria. The population of the study comprised of students and lecturers from psychology department in all government owned tertiary institutions in Rivers State. A sample size 150 respondents (145 students and 5 lecturers) was selected from each of the eight government tertiary institutions, making a total of 1200 respondents selected using a stratified random sampling technique to ensure representation from various institutions and demographics within Rivers State. Data was collected using a structured questionnaire designed to capture perceptions and experiences related to AI's impact on cognitive skills, learning outcomes, and educational processes.

The questionnaire underwent validation by experts and a pilot test to ensure reliability. Data analysis was conducted using descriptive statistics with a mean criterion of 3.0 using 5 Likert scale [Strongly Agreed (SA) = 5/25, Agreed (A) = 4/16, Neutral (N) = 3/9, Disagreed (D) = 2/4, Strongly Disagreed (SD) = 1/1] and inferential statistics to address the research objectives and provide insights into AI's effects on the cognitive domain of tertiary institutions students in Rivers State. The study was conducted in accordance with the principles of ethical research. The participants were informed of the purpose and scope of the study, and their consent was obtained before collecting data and the data were kept confidential and anonymous.

Results

From table 1 above shows distribution of the questionnaire, it is seen that the questionnaire was distributed evenly among the various tertiary institution in Rivers State of which respondents from Ignatius Ajuru University have the highest retrieved questionnaire (136) while National Open University Port Harcourt study centre have the lowest respondents of 98.

Presentation of Data

The data analysis is based on research objectives. Primary data were reviewed. In the main analyses, participants were identified according to demographic characteristics. Age, gender, and all other demographic variables are calculated as percentages. In secondary analysis we use standard deviations and mean for descriptive statistics.

Table 1. Demography Distributions of the Questionnaires

Names of Selected Institutions	Names of Department Selected	Age/Level of Students	Academic Rank of Selected Lecturers	No. of Questionnaire Distributed/Returned Students/Lecturers	
• University of Port Harcourt	Psychology	20-30/400L	Senior Lecturer	145/117	5/4
• Rivers State University	Psychology	20-30/400L	Senior Lecturer	145/119	5/5
• Ignatius Ajuru University of Education	Psychology	20-30/400L	Senior Lecturer	145/136	5/5
• National Open University	Psychology	20-30/400L	Senior Lecturer	145/98	5/3
• Ken Sarowiwa Polytechnic	Computer Science	20-30/400L	Senior Lecturer	145/112	5/4
• Captain Elechi Amadi Polytechnic	Computer Science	20-30/400L	Senior Lecturer	145/106	5/5
• Rivers State College of Health Sciences	Psychology	20-30/400L	Senior Lecturer	145/110	5/4
• Federal College of Technology	Psychology	20-30/400L	Senior Lecturer	145/106	5/5
				Total = 1200/899	

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Table 2. Socio-demographic characteristics of the Respondents

Socio-Demographic Characteristics	Frequency	Percentage
Gender		
Male	407	45.3
Female	492	54.7
Total	899	100
Status		
Students	859	95.6
Lecturers	40	4.4
Total	899	100
Age Bracket		
20-30 years	826	91.9
31 years and above	73	8.1

Total	899	100
Educational Qualification		
SSCE	847	94.2
NCE/OND/BSC/MSc/PhD	52	5.8
Total	899	100
Total	899	100

Table 2 present the details of the population. In all the 899 respondents, majority of the students are female constituting of 492 (54.7% of the total) and 407 males (45.3% of the total). In the age bracket, majority of the respondents falls within 20-30 years; Similarly, when asked about their educational qualification, 847 (94.2%) of the respondents are SSCE holders which constitute the highest respondents.

Data Analysis

In order to determine the validity of the research questions, the data of this study were presented and analyzed below using standard deviation, SPSS software and Cronbach Alpha correlation coefficient. These perceptions are identified through the survey questionnaire, and focus group discussions with students.

Research Question 1

What is the level of usage and integration of AI tools in tertiary institutions in Rivers State, Nigeria?

Table 3. Respondent perception on the levels of usage and integration of AI tools in tertiary institutions in Rivers State, Nigeria

S/N	Factors	SA	A	N	D	SD	Mean	Std
1	AI adapts content to individual students' learning styles and pace, enhancing outcomes in Rivers State tertiary institutions students thereby improving results annually.	346	295	0	97	161	3.6	1.1
2	AI provides one-on-one support for subjects like math and science, boosting tertiary students understanding in Rivers State, improving academic performance always targeted.	409	332	3	28	12	3.9	0.8
3	AI speeds up grading, reduces teacher workload, enhances feedback quality in Rivers State thereby improving efficiency remarkably every year.	174	653	1	34	137	4.0	0.9
	AI chatbots answer student queries, provide study tips, supporting learning in Rivers State which enhance engagement levels.	385	417	6	52	39	4.2	0.7
4	AI adjusts question difficulty based on student performance, thereby improving accuracy in tertiary students of Rivers State.	268	399	2	144	86	3.7	1.0
	AI tracks student progress, identifies areas for improvement, informing interventions that enhances data-driven outcome.	447	305	0	69	68	4.1	0.8
5	Resources based on student interests, needs, personalizing learning in are always tailored by AI.	316	387	4	82	100	3.8	1.0
	AI helps students with language barriers access content, which promote inclusivity thereby enhancing students understanding.	394	416	8	47	34	4.2	0.7
6	AI creates interactive simulations for complex subjects in Rivers State tertiary institutions.	522	312	5	43	7	4.4	0.6
	AI monitors, predicts student engagement levels.	287	496	10	86	20	4.1	0.8
7								
8								
9								
10								
Aggregate Mean							4.0	0.9

As deduced from table 3, item 1-10, it shows that the aggregate mean of the items is above the mean criterion of 3.0. Also, based on all responses, the aggregate mean and standard deviation is 4.0 and 0.9 indicating that the respondents all agreed that the item above are level of usage and integration of AI tools in tertiary institutions in Rivers State, Nigeria.

Research Question 2

What is the impact of AI on students' cognitive skills and learning outcomes in tertiary institutions in Rivers State, Nigeria?

Table 4. Respondent perception on the impacts of AI on students' cognitive skills and learning outcomes in tertiary institutions in Rivers State, Nigeria

S/N	Factors	SA	A	N	D	SD	Mean	Std	Decision
1	AI promotes analytical skills through complex problem-solving activities.	414	382	2	81	20	4.2	0.8	Agreed
2	AI-driven exercises boost students' logical reasoning abilities.	502	266	1	43	87	4.2	0.9	Agreed
3	AI tailors content to individual learning styles and pace.	611	171	0	51	66	4.3	0.7	Agreed
4	Interactive AI tools make learning more engaging, effective.	341	229	6	212	111	3.5	1.1	Agreed
4	AI aids understanding, leading to improved knowledge retention.	425	309	3	67	95	4.0	0.8	Agreed
	AI speeds up feedback, enhancing student progress tracking.								
5	AI tools inspire innovative thinking, project-based learning.	198	612	1	66	22	4.0	0.9	Agreed
	AI facilitates group work, peer learning opportunities.	543	187	4	59	106	4.1	0.8	Agreed
6	A AI helps students prioritize tasks, and manage study time.	260	496	12	113	8	4.0	1.0	Agreed
	AI empowers students to take ownership of learning.	313	388	5	90	103	3.8	0.9	Agreed
7	AI identifies and addresses knowledge gaps efficiently.	455	277	8	736	85	4.0	0.6	Agreed
	AI-driven insights lead to improved exam performance.	602	194	2	36	65	4.4	0.7	Agreed
8		579	201	7	82	30	4.3	0.5	Agreed
9									
10									
11									
12									
Aggregate Mean							4.1	0.8	Agreed

From table 4, item 1-12, it shows that the aggregate mean of the items is above the mean criterion of 3.0. Also, based on all responses, the aggregate mean and standard deviation is 4.1 and 0.8 respectively indicating that the respondents all agreed that the item above are the impact of AI on students' cognitive skills and learning outcomes in tertiary institutions in Rivers State, Nigeria.

Research Question 3

What are the challenges and opportunities of AI adoption in tertiary institutions in Rivers State, Nigeria?

Table 5. Respondent perception on the challenges and opportunities of AI adoption in tertiary institutions in Rivers State, Nigeria

S/N	Factors	SA	A	N	D	SD	Mean	Std	Decision
Challenges									
1	Inadequate technology infrastructure hinders effective AI integration and adoption processes in Rivers State tertiary institutions which significantly impacting implementation.	712	99	11	27	50	4.6	0.6	Agreed
2	Educators require comprehensive skills training to effectively utilize AI tools and maximize benefits in teaching and learning processes in tertiary institutions in Rivers State.	533	245	6	43	72	4.3	0.8	Agreed

3	Unequal access to AI technologies may widen existing educational disparities among students in tertiary institutions in Rivers State.	442	375	3	59	20	4.3	0.7	Agreed
	Student data security and privacy protection pose critical concerns requiring robust safeguards in AI adoption in Rivers State tertiary institutions always.	512	296	9	63	22	4.4	0.7	Agreed
4	Opportunities	313	487	14	37	48	4.1	0.8	Agreed
	AI offers tailored learning experiences adapting to individual student needs and learning styles in Rivers State tertiary institutions thereby boosting outcomes.	396	292	10	51	150	3.8	1.0	Agreed
5	AI automates administrative tasks freeing time for teaching and enhancing educational efficiency in the State tertiary institutions which promote better outcomes.	611	160	6	46	76	4.3	0.7	Agreed
	AI introduces interactive and engaging content transforming traditional learning approaches in Rivers State tertiary institutions that enhance engagement.	499	273	0	101	26	4.2	0.8	Agreed
6	AI identifies and addresses knowledge gaps efficiently improving learning outcomes for students in Rivers State tertiary institutions bridging disparities.	520	234	2	33	100	4.1	0.9	Agreed
	Limited financial resources and funds hinder AI implementation and sustainability in tertiary institutions in Rivers State.	348	418	9	68	56	4.0	0.8	Agreed
7	AI integration requires understanding local cultural context and adapting tools for relevance in Rivers State Nigeria educational settings ensuring effectiveness.	444	272	5	42	136	4.0	0.7	Agreed
	AI equips students with essential skills for a technology-driven world enhancing employability in tertiary education students in Rivers State.	661	79	3	57	89	4.3	0.6	Agreed
8	AI adoption may require engaging parents in understanding benefits and addressing concerns in the State institutions improving support systems.	515	288	8	22	66	4.3	0.5	Agreed
	Ensuring AI systems are fair and unbiased is critical for equitable education delivery in Rivers State tertiary institutions promoting inclusivity.								
10									
11									
12									
13									
Aggregate Mean							4.2	0.8	Agreed

From table 5, item 1-13, it shows that the aggregate mean of the items is above the mean criterion of 3.0. Also, based on all responses, the aggregate mean and standard deviation is 4.2 and 0.8 respectively indicating that the respondents all agreed that the item above are the challenges and opportunities of AI adoption in tertiary institutions in Rivers State, Nigeria.

Discussion

Based on the response of the respondents from table 3 above, the study found out that students learning pace and outcome have been enhanced, boost understanding, reduction of workload, etc are the levels of usage and integration of AI tools in tertiary institutions in Rivers State which is in line with the study of Schmidt et al, (2025); Fitas, (2025); Seo et al, (2021) and also in support of cognitive load theory. The findings indicate AI tools like personalized learning paths, intelligent tutoring systems, and automated grading are being utilized, aligning with constructivist learning principles (Wang et al, (2024); Al Nabhani et al. (2025) and enhancing cognitive skills development.

Also again, based the response of the respondents from table 4 above, the study found out that AI promotes analytical skills, boosts logical reasoning, enhances engagement, improves retention, and leads to better exam performance, supporting the studies of (Hu et al., 2025; Bai, 2025). These impacts align with cognitive load theory (Mariyono & Nur Alif Hd, 2025); (Kerimbayev et al., 2025) as AI manages cognitive load, personalizing learning and enhancing germane load. AI's role in scaffolding learning contributes to improved cognitive skills and outcomes.

From table 5 above, based on the response of the respondents, the study identified challenges like inadequate infrastructure, need for teacher training, equity access concerns, and data privacy risks, alongside opportunities like enhanced personalization, efficiency, innovative tools, and future-ready skills. These findings echo studies by (Herawati et al., 2024) highlighting AI's potential benefits and implementation hurdles in Rivers State, Nigeria.

Conclusion

This study investigated the effects of artificial intelligence on the cognitive domain of tertiary institution students in Rivers State, Nigeria. The findings revealed significant usage and integration of AI tools, positively impacting students' cognitive skills and learning outcomes. AI's role in personalizing learning, enhancing engagement, and improving cognitive development aligns with cognitive load theory and constructivist learning principles. Challenges like infrastructure limitations, training needs, and equity concerns coexist with opportunities for enhanced learning and future-ready skills. The study underscores AI's potential in transforming Rivers State's tertiary education, emphasizing careful implementation and strategic investments. Further research could explore longitudinal effects of AI on cognitive development, comparative analyses of AI adoption across Nigerian states, impact of AI on specific subjects like STEM, and strategies for addressing AI implementation challenges in resource-constrained settings. Investigating teacher and student perceptions, AI's role in inclusive education, and ethical implications of AI in Nigerian schools could provide deeper insights, informing policies and practices for maximizing AI's benefits in Rivers State and beyond.

Conflicts of Interest

The author declares that there are no conflicts of interest related to this research.

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Author contribution

Conceptualization: N. U. and R. C. C.; methodology, C. E. O.; software, R. C. C.; validation, N. U. and C. E. O.; formal analysis, R. C. C.; investigation, C. E. O.; resources, N. U.; data curation, N. U.; writing-original draft preparation, N. U.; writing—review and editing, R. C. C.; visualization, N. U.; supervision, R. C. C.; project administration, C. E. O; funding acquisition, C. E. O. All authors have read and agreed to the published version of the manuscript.

Declaration of generative AI in scientific writing

The author acknowledges having used the Generative AI tool Grammarly-AI for grammar/language improvement. The author is solely responsible for all published content and has verified the accuracy and authenticity of the AI output.

References

- Adewale, M. D., Azeta, A., Abayomi-Alli, A., & Sambo-Magaji, A. (2024). Impact of artificial intelligence adoption on students' academic performance in open and distance learning: A systematic literature review. *Heliyon*, 10(22), e40025. <https://doi.org/10.1016/j.heliyon.2024.e40025>

- Aksel Stenberdt, V., & Makransky, G. (2023). Mastery experiences in immersive virtual reality promote pro-environmental waste-sorting behavior. *Computers & Education*, 198, 104760. <https://doi.org/10.1016/j.compedu.2023.104760>
- Al Nabhani, F., Hamzah, M. B., & Abuhassna, H. (2025). The role of artificial intelligence in personalizing educational content: Enhancing the learning experience and developing the teacher's role in an integrated educational environment. *Contemporary Educational Technology*, 17(2), ep573. <https://doi.org/10.30935/cedtech/16089>
- Bai, Y. (2025). Exploring the role and impact of artificial intelligence in personalized foreign language teaching. *Discover Artificial Intelligence*, 5(1), 318. <https://doi.org/10.1007/s44163-025-00546-9>
- Du Plooy, E., Casteleijn, D., & Franzsen, D. (2024). Personalized adaptive learning in higher education: A scoping review of key characteristics and impact on academic performance and engagement. *Heliyon*, 10(21), e39630. <https://doi.org/10.1016/j.heliyon.2024.e39630>
- Fitas, R. (2025). Inclusive education with AI: Supporting special needs and tackling language barriers. *AI and Ethics*, 5(6), 5729–5757. <https://doi.org/10.1007/s43681-025-00824-3>
- Garzón, J., Patiño, E., & Marulanda, C. (2025). Systematic Review of Artificial Intelligence in Education: Trends, Benefits, and Challenges. *Multimodal Technologies and Interaction*, 9(8), 84. <https://doi.org/10.3390/mti9080084>
- Guan, L., Liang, H., & Zhu, J. J. H. (2022). Predicting reposting latency of news content in social media: A focus on issue attention, temporal usage pattern, and information redundancy. *Computers in Human Behavior*, 127, 107080. <https://doi.org/10.1016/j.chb.2021.107080>
- Haetami, H. (2025). AI-Driven Educational Transformation in Indonesia: From Learning Personalization to Institutional Management. *AL-ISHLAH: Jurnal Pendidikan*, 17(2), 1819–1832. <https://doi.org/10.35445/alishlah.v17i2.7448>
- Herawati, A. A., Yusuf, S., Ilfiandra, I., Taufik, A., & Ya Habibi, A. S. (2024). Exploring the Role of Artificial Intelligence in Education, Students Preferences and Perceptions. *AL-ISHLAH: Jurnal Pendidikan*, 16(2), 1029–1040. <https://doi.org/10.35445/alishlah.v16i2.4784>
- Hu, C., Li, F., Wang, S., Gao, Z., Pan, S., & Qing, M. (2025). The role of artificial intelligence in enhancing personalized learning pathways and clinical training in dental education. *Cogent Education*, 12(1), 2490425. <https://doi.org/10.1080/2331186X.2025.2490425>
- Kerimbayev, N., Adamova, K., Shadiev, R., & Altinay, Z. (2025). Intelligent educational technologies in individual learning: A systematic literature review. *Smart Learning Environments*, 12(1), 1. <https://doi.org/10.1186/s40561-024-00360-3>
- Mariyono, D., & Nur Alif Hd, A. (2025). AI's role in transforming learning environments: A review of collaborative approaches and innovations. *Quality Education for All*, 2(1), 265–288. <https://doi.org/10.1108/QEA-08-2024-0071>
- Mohamed, A. M., Shaaban, T. S., Bakry, S. H., Guillén-Gámez, F. D., & Strzelecki, A. (2025). Empowering the Faculty of Education Students: Applying AI's Potential for Motivating and Enhancing Learning. *Innovative Higher Education*, 50(2), 587–609. <https://doi.org/10.1007/s10755-024-09747-z>
- Mustafa, M. Y., Tlili, A., Lampropoulos, G., Huang, R., Jandrić, P., Zhao, J., Salha, S., Xu, L., Panda, S., Kinshuk, López-Pernas, S., & Saqr, M. (2024). A systematic review of literature reviews on artificial intelligence in education (AIED): A roadmap to a future research agenda. *Smart Learning Environments*, 11(1), 59. <https://doi.org/10.1186/s40561-024-00350-5>
- Rahiman, H. U., & Kodikal, R. (2024). Revolutionizing education: Artificial intelligence empowered learning in higher education. *Cogent Education*, 11(1), 2293431. <https://doi.org/10.1080/2331186X.2023.2293431>
- Schmidt, D. A., Alboloushi, B., Thomas, A., & Magalhaes, R. (2025). Integrating artificial intelligence in higher education: Perceptions, challenges, and strategies for academic innovation. *Computers and Education Open*, 9, 100274. <https://doi.org/10.1016/j.caeo.2025.100274>

- Seo, K., Tang, J., Roll, I., Fels, S., & Yoon, D. (2021). The impact of artificial intelligence on learner–instructor interaction in online learning. *International Journal of Educational Technology in Higher Education*, 18(1), 54. <https://doi.org/10.1186/s41239-021-00292-9>
- Vieriu, A. M., & Petrea, G. (2025). The Impact of Artificial Intelligence (AI) on Students' Academic Development. *Education Sciences*, 15(3), 343. <https://doi.org/10.3390/educsci15030343>
- Wang, S., Wang, F., Zhu, Z., Wang, J., Tran, T., & Du, Z. (2024). Artificial intelligence in education: A systematic literature review. *Expert Systems with Applications*, 252, 124167. <https://doi.org/10.1016/j.eswa.2024.124167>