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Assessing the Influence of Fourth Industrial Revolution (4IR) Technologies on the Development of Basic School Learners in Nigeria

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Abstract

Nigerian society is witnessing an increase in depression and cyberbullying among the young generation, which has been traced to the constant use of technology, thereby raising concerns about its impact on a child's development. This study explores the influence of 4IR technologies on multiple dimensions of development among basic school learners in Nigeria. The research method for this study was a descriptive survey. Anchored in developmental and socio-cultural learning theories, the research employed a descriptive survey design involving 2,400 Basic Five pupils across 160 Ogun East Senatorial District schools. Data were collected using a validated, researcher-designed questionnaire and analysed through Percentage, grand mean, and multiple regression analysis. The questionnaire's reliability was measured using the test-retest method, with an index of 0.83 obtained via Pearson Product Moment Correlation (PPMC). Findings revealed a statistically significant influence of 4IR technologies on cognitive development ($\beta = .360$, $p < .001$), suggesting that digital tools positively contribute to learners' memory, attention, and problem-solving skills. However, emotional, social, and physical development domains showed no significant influence, highlighting limitations in the holistic developmental impact of unstructured or unsupervised digital exposure. These results emphasise the need for educational policies that embed socio-emotional learning and teacher-guided digital engagement within Nigeria's basic education curriculum.

Keywords: Fourth Industrial Revolution (4IR), Nigerian basic education system, technology and child development, digital learning, technology integration in education, digital literacy.

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All ethical declarations related to this article are provided on the final page of the manuscript. (Page: 1304).

Nigerian society is witnessing an increase in behavioural problems such as anxiety, depression, cyberbullying, and even suicide among the young generation, anomalies that were not as prominent in the past (UNICEF, 2014). Within the specific context of Nigeria's evolving educational landscape, these issues have been increasingly traced to the constant and often unsupervised use of technology, raising significant public and scholarly concerns about its impact on a child's holistic development. The rapid advancement of the Fourth Industrial Revolution (4IR) characterised by the integration of physical assets with cutting-edge digital technologies like the Internet of Things (IoT), artificial intelligence (AI), and cloud computing is fundamentally reshaping many facets of life, including childhood development (Jules, 2017; Baaitjies, 2019; Odutayo & Ramsaroop, 2023; World Economic Forum, 2019). As young children in Nigeria increasingly interact with computers, cell phones, and tablets (Corfe, 2019; Yusuf et al., 2018), a critical question emerges: how does this exposure influence the multiple, interconnected domains of a child's development?

Understanding this complex interplay requires a robust theoretical foundation. Piaget's concrete operational stage, which explains the development of logical thinking and problem-solving abilities in children aged 7–11, provides a lens through which to view the potential cognitive advantages of 4IR tools (McLeod, 2024). Interactive applications and AI-based learning platforms can support a child's transition from concrete to more abstract thought processes. Complementing this, Vygotsky's socio-cultural theory, particularly the concept of the Zone of Proximal Development (ZPD), posits that learning is a social process mediated by tools and guidance (Hong & Delusto, 2020). From this perspective, virtual classrooms and instructional software can act as mediating aids, scaffolding learning when integrated effectively.

Furthermore, Bronfenbrenner's Ecological Systems Theory situates this technological interaction within a nested structure of environmental influences. Digital tools operate within the microsystem (direct interactions with teachers and peers) and mesosystem (home-school connections), while broader factors like school infrastructure, community internet access (exosystem), and national educational policies (macrosystem) critically shape the nature and extent of a child's exposure and learning opportunities (Ettekal & Mahoney, 2017; Hayes et al., 2017). Together, these theories provide a multi-layered framework: Piaget helps us understand the cognitive structures being developed, Vygotsky illuminates the social mediation of learning through technology, and Bronfenbrenner ensures we consider the entire ecosystem from a child's immediate classroom to national policy that determines whether 4IR technologies become a developmental asset or a liability.

Building upon these theoretical insights, the existing literature reveals a tension regarding technology's impact, particularly in the cognitive domain. While some studies praise digital tools for enhancing learning, others caution against excessive use. Research by Saarinen et al. (2021) in Finnish classrooms found that frequent ICT

use correlated with poorer cognitive outcomes, while Ebunoluwa (2017) and Gottschalk (2019) reported that overexposure may reduce attention spans and hinder information processing. The rapid visual stimulation from screens may alter brain development, potentially decreasing imagination and sustained focus (Brody, 2015; Evans, 2019). However, the outcomes are not monolithic; scholars like Kostyrka-Allchorne et al. (2017), Odutayo & Fonseca (2024), and Uncapher et al. (2017) emphasise that supervision, content quality, and the level of engagement are pivotal factors, suggesting that technology can support learning within a child's ZPD when guided by adults.

This ambiguity is even more pronounced in the social and emotional domains. Some researchers warn that overreliance on digital devices can reduce face-to-face interactions, weaken communication skills, and heighten the risk of cyberbullying (Lowery, 2023; Oyinkansola, 2019), potentially impairing the development of empathy and emotional intelligence. Conversely, other studies argue that when used appropriately, such as through video calls or collaborative educational apps, technology can help children build relationships and foster teamwork (Johnson, 2019; Cantwell, 2020). Similarly, the physical domain is a primary concern, with extensive literature linking prolonged screen time to sedentary habits, obesity, and musculoskeletal issues (Alotaibi et al., 2020; Oswald et al., 2020). A more nuanced reading of the literature also suggests that the very nature of the technology matters; for instance, interactive and creative applications may offer different developmental outcomes compared to passive content consumption (Odutayo et al., 2023; Siregar & Yaswinda, 2021). However, when contextualising these global debates, a critical and consistent limitation of this existing body of work is its predominant origin in high-income countries, creating a significant gap in understanding these dynamics within African contexts like Nigeria, where socio-cultural factors, digital infrastructure, teacher readiness, and parental involvement differ markedly (Loes & Saichaie, 2016; Peters, 2017; Komolafe, 2018).

To address this gap within the Nigerian framework, this research focused on Basic Five pupils within the 9-3-4 education structure, a critical period for cognitive development and the early introduction to formal digital learning tools. Pupils in Basic 5 are typically between 8 and 11 years old. However, the implementation of technology is inconsistent. Many public basic schools, especially in rural settings, suffer from inadequate electricity, limited internet access, and a shortage of devices. Furthermore, cultural norms and parental skepticism toward screen time, compounded by economic limitations, affect children's access to and use of digital resources outside school. Therefore, this study investigates the influence of 4IR technology use on the cognitive, social, emotional, and physical development of basic school learners in the Ogun East Senatorial District, Nigeria. It seeks to answer the following research questions:

i. What is the level of 4IR technology use among basic school learners?

ii. What is the extent of basic school learners' cognitive, social, emotional, and physical development gained from 4IR?
iii. Is the level of 4IR technology use a significant predictor of primary school learners' cognitive, emotional, social, and physical development scores?

Method

Research Model

The research approach for this study was a descriptive survey research method because it facilitates data evaluation and contributes to the researcher's deepening understanding of the research topic.

Universe-Sample / Study Group

This study was conducted in Ogun East Senatorial District, one of the three senatorial zones in Ogun State, located in the Southwestern region of Nigeria. The district comprises urban, peri-urban, and rural communities, including Ijebu-Ode, Sagamu, and Ijebu North-East. It represents a socioeconomically diverse educational environment, with disparities in access to modern infrastructure and digital tools across schools. These variations make the region a valuable case for examining the heterogeneous influence of 4IR technologies on learner development. All Basic school pupils in Ogun East Senatorial district served as the population for this study. Purposively, basic five pupils served as the target population. Interactions with parents, guardians, and teachers suggest that children at this level have sufficient exposure to technology, which may influence their overall development. There are 2,090 basic schools in the selected senatorial district with an estimated teacher size of 41,312 (Ogun State Ministry of Education, 2021).

Based on methodological and statistical considerations, the study's sample size of 381 respondents was chosen to guarantee the reliability and representativeness of its findings. According to the research advisor's sample size determination table, to obtain results with a 95% confidence level and a 5% margin of error, a population larger than 1,000 needs a minimum sample of about 381. This sample size was chosen in accordance with accepted quantitative research procedures, guaranteeing that the data gathered are controllable and sufficiently reliable for insightful analysis.

The researcher adopted a multistage sampling technique. In the first stage, a stratified sampling technique was employed to group basic schools based on the nine local government areas. Next, random sampling was employed to select five local government areas. A proportionate sampling technique was used to determine 160 basic schools. These schools were selected based on the number commensurate with the selected LGAs. Lastly, 15 pupils were randomly sampled in each of the selected basic schools, amounting to 2400 respondents.

Data Collection Tools

A researcher-designed questionnaire titled *4IR Technologies' Influence on Learners' Development* was used for this study. The questionnaire had five sections:

Section A was used to generate the demographic characteristics of the respondents, Section B consisted of five items relating to cognitive development, and Section C focused on social development with seven items. Section D comprises nine items on emotional development, while Section E contains seven items on physical development. The questionnaire was administered with the assistance of 15 research assistants. The instrument's validity was established through expert review by specialists in childhood education, educational measurement, and evaluation, whose feedback and recommendations were incorporated to refine and improve the instrument. They conducted an extensive assessment of the questionnaire to examine clarity, linguistic appropriateness, and item relevance, ensuring alignment with the specified developmental constructs. Their analysis confirmed that the items within each domain (cognitive, social, emotional, and physical development) demonstrated adequate construct representation, encompassing the breadth of behaviors and attributes pertinent to learner development, as substantiated by contemporary literature and established developmental benchmarks. Confirmatory Factor Analysis (CFA) was not utilised in this study due to the questionnaire being in the preliminary phase of preparation and its factor structure lacking prior establishment. Exploratory Factor Analysis (EFA) was utilised to identify the underlying dimensions, which will serve as the empirical foundation for subsequent confirmatory testing. The researcher conducted the Exploratory Factor Analysis (EFA) using Principal Axis Factoring with Varimax rotation on the 28-item instrument to establish construct validity. The Kaiser-Meyer-Olkin measure verified sampling adequacy (KMO = 0.86), and Bartlett's test of sphericity was significant ($\chi^2 = 8450.71$, $p < 0.001$), indicating suitability for factor analysis. Four factors emerged with eigenvalues >1, explaining 64.2% of the variance. Each item loaded strongly (≥0.50) onto the expected factors: cognitive, social, emotional, and physical development. This supported the multidimensional structure of the instrument. The reliability of the instrument was assessed using the test-retest method. A reliability index 0.83 was obtained via Pearson Product Moment Correlation (PPMC).

Ethical Committee Approval

To ensure compliance with international research standards, ethical clearance was obtained from the Faculty of Education Ethical Review Board, University of … (Approval Code: …), and formal consent was secured from parents/guardians through signed consent forms, which clearly outlined the study's purpose, voluntary nature, and confidentiality measures. Child-friendly assent forms were explained verbally to learners in simple language to ensure their understanding and voluntary participation. To protect data privacy in this large-scale school-based study, all questionnaires were anonymised with no identifying information, and data were stored in encrypted, password-protected files accessible only to the research team. Hard copies were secured in locked storage and will be destroyed after the designated retention period. Schools and individual participants are not identifiable in any publications or reports, ensuring all respondents' dignity, rights, and confidentiality are fully protected.

Analysis of Data

Percentage was used to answer research question one, while the grand mean was used to answer research questions two– four. The hypothesis generated was tested with a multivariate regression analysis at 0.05 level of significance. For the sixth research question, multivariate regression analysis (MRA) was used at the 0.05 level of significance. Multiple regression is the process of using two or more independent variables to predict a single dependent variable. On the other hand, multivariate regression examines the impact of one or more predictors on two or more dependent variables at the same time. Multivariate regression was the most appropriate option for this study, which investigated how 4IR technologies (an independent variable) affected the four developmental domains of cognitive, social, emotional, and physical development. This method reduced Type I error and reflected the multifaceted nature of childhood development by enabling the simultaneous examination of associated developmental outcomes.

Results

RQ 1: What is the level of 4IR technology use among Basic school learners?

The scores of each participant on readiness towards online-based data collection methods were subjected to percentage analysis. Given that the questionnaire contained five items structured in four responses, the minimum, maximum, and range scores were 5, 20, and 15, respectively. The range was therefore divided by 4-response of Always, Sometimes, Rarely, and Never (i.e., 15/4=3.75). Thus, respondents' scores that fell within 5 – 8, 9-12, 13 – 16, and 17 - 20 were categorized as always, sometimes, rarely, and never, respectively, as the level of 4IR technology among basic school learners. The statistics of the participants' responses are presented in Table 1.

Table 1
Level of 4IR Use among Basic School Learners

Level of Use	Score Range	Frequency	Percentage (%)
Always	17 – 20	704	29.3
Sometimes	13 – 16	892	37.2
Rarely	9 - 12	578	24.1
Never	5 – 8	226	9.4
Total		2400	100.0

Table 1 reveals that 132 (29.3%) of the respondents affirmed that learners always use 4IR technology; 151 (37.2%) submitted that sometimes they make use of 4IR technologies; 83 (24.1%) affirmed that learners rarely use 4IR technologies; while 34 (9.4%) submitted that learners never make use of 4IR technology. Therefore, most respondents (37.2%) reported that learners sometimes used 4IR technologies.

RQ 2: What is the extent of learners' cognitive development gained from 4IR?

Participants' responses were subjected to item-by-item analysis of mean and standard deviation, which were further subjected to summative (grand) mean. Given that the questionnaire items on learners' cognitive development were structured in a four-response-type, the mean scores close to 1.0, 2.0, 3.0, and 4.0 signify low, moderate, high, and very high extents, respectively.

Table 2

The Extent of Learners' Cognitive Development Gained from 4IR

SN	**Cognitive Development**	**Mean**	**S.D.**
1	My cognitive development has been sizable due to a sufficient balance between 4IR technologies and other non-digital activities.	3.31	1.35
2	My problem-solving skill improves with the use of 4IR technologies.	3.23	1.31
3	4IR technologies enhance my creativity skills.	3.12	1.22
4	4IR technologies positively influence my ability to process information and learn.	3.09	1.17
5	4IR technologies improve my attention span.	2.81	1.11
6	Spending time on 4IR technologies fosters my memory and critical thinking abilities.	2.14	0.88
	Grand Mean	**2.95**	
	Remark	**High Extent**	

As revealed in Table 2, the extent of cognitive development gained from 4IR by basic learners was high, and the grand mean score of 2.95 (close to 3.0) was attained. Hence, learners' cognitive development has been sizable due to a sufficient balance between 4IR technologies and other non-digital activities. Problem-solving skills improve using 4IR technologies, enhancing learners' creativity skills.

RQ 3: What is the extent of social development of learners gained from 4IR?

Participants' responses were subjected to item-by-item analysis of mean and standard deviation, which were further subjected to summative (grand) mean. Given that the questionnaire items on learners' social development were structured in a four-response-type, the mean scores close to 1.0, 2.0, 3.0, and 4.0 signify low, moderate, high, and very high extents, respectively.

Table 3
The extent of social development of learners gained from 4IR

SN	Social Development	Mean	S.D.
1	I frequently adopt 4IR technologies as the primary means of interacting with friends, peers, and family, which enhances my social skills.	2.83	1.14
2	Online group activities or educational apps enhance my ability to collaborate and work in teams.	2.71	1.01
3	Proper supervision of online interactions ensures my safety.	2.59	0.92
4	Balancing 4IR technologies with other face-to-face social activities positively supports my overall social development.	2.36	0.84
5	Engaging in social media or other digital platforms is allowing me to believe in myself.	2.07	0.81
6	Frequent use of 4IR technologies promotes healthy social abilities.	1.95	0.83
7	Prolonged use of 4IR technologies does not negatively impact my face-to-face social interactions.	1.41	0.78
8	Online communities and digital platforms do not negatively influence my ability to connect with others face-to-face.	1.33	0.71
	Grand Mean	**2.17**	
	Remark	**Moderate Extent**	

Table 3 shows a moderate extent of social development gained from 4IR by basic learners, given the obtained mean score of 2.17. This indicates that 4IR technologies moderately influence learners' social skills as the primary means of interacting with friends, peers, and family enhances my social interaction skills with peers and family as well as social development, making learners believe in themselves through social media and other online digital platforms and promoting healthy social abilities with no interference with face-to-face social interactions.

RQ 4: What is the learners' emotional development level gained from 4IR?

Participants' responses were subjected to item-by-item analysis of mean and standard deviation, which were further subjected to summative (grand) mean. Given that the questionnaire items on learners' emotional development were structured in a four-response-type, the mean scores close to 1.0, 2.0, 3.0, and 4.0 signify low, moderate, high, and very high levels, respectively.

Table 4
Level of learners' emotional development gained from 4IR

N	Emotional Development	Mean	S.D.
1	There have been potential drawbacks or adverse effects on my emotional development from using 4IR technologies.	1.45	1.16
2	Supervising my screen time ensures a healthy balance and supports my emotional development.	1.38	1.08
3	Interactive learning platforms and educational apps enhance my emotional engagement and learning motivation.	2.04	1.07
4	Using 4IR technologies allows me to cope with stress or challenging situations.	1.12	1.02
5	My emotional expressions or mood can be improved using 4IR technologies.	1.76	0.97
6	4IR technologies positively impact my emotional literacy and understanding of emotions.	1.21	0.91
7	Exposure to specific content through 4IR technologies (e.g., social media, videos) does not negatively affect my emotional wellbeing.	1.14	0.87
8	Putting myself and understanding other people's perspectives is improving through the use of 4IR technologies.	1.36	0.79
	Grand Mean		**1.43**
	Remark		**Low**

As depicted in Table 4, learners gained a low level of emotional development from 4IR since the mean score of 1.43 was close to 1.0. Hence, learners' emotional wellbeing, engagement, and learning motivation, emotional literacy and understanding of emotions, and knowledge of other people's perspectives gained from 4IR were low.

RQ 5: What is the level of physical development of learners gained from 4IR?

Participants' responses were subjected to item-by-item analysis of mean and standard deviation, which were further subjected to summative (grand) mean. Given that the questionnaire items on learners' physical development were structured in a four-response-type, the mean scores close to 1.0, 2.0, 3.0, and 4.0 signify low, moderate, high, and very high levels, respectively.

Table 5
The level of physical development of learners from 4IR

N	Physical Development	Mean	S.D.
1	My interest in outdoor play and physical exploration is not reducing due to my addiction to 4IR technologies.	1.31	1.35
2	My level of physical activity is not reducing due to regular usage of 4IR technologies.	1.46	1.06

(continuing)

Table 5 (continued)

3	Insufficient regulation of 4IR technology use affects my physical development.	1.29	0.98
4	Extended usage of 4IR technologies affects my posture and musculoskeletal health.	1.28	0.97
5	I feel fatigued and have eye strain after excessive use of 4IR technologies.	1.41	0.92
6	Constant use of 4IR technologies positively influences my physical fitness and overall health.	1.19	0.87
7	My sleep patterns are not disrupted because of the excessive use of 4IR technologies.	1.33	0.74
	Grand Mean	**1.32**	
	Remark	**Low**	

Table 5 revealed a low level of physical development of learners from 4IR. This implies that learners' outdoor play and physical exploration are not reduced due to their addiction to 4IR technologies, i.e., their level of physical activity, posture, musculoskeletal health, physical fitness, and overall health are not reduced due to regular usage of 4IR technologies.

RQ 6: Is the level of 4IR technology use a significant predictor of primary school learners' cognitive, emotional, social, and physical development scores?

The above hypothesis was tested using a multivariate regression analysis at 0.05 level of significance. Before conducting a linear regression analysis, the researcher tested the multicollinearity and independence of errors to ensure whether the data satisfied the ***assumptions of multivariate analysis or not***. Thus, the tolerance value and variance inflation factor (VIF) was calculated to verify multicollinearity while producing Durbin-Watson statistic to test the independence of errors. As a result, there was no multicollinearity between any dependent variables in that the tolerance values ranged from .566 to .966, and VIFs were between 1.035 and 1.766. Since the Durbin-Watson statistic was 2.000, there was no autocorrelation in residuals. Also, no significant outlier was detected, while the residual errors were normally distributed, ranging from -3.19 to 2.00. Having met the assumptions above, this study performed a multivariate regression analysis to verify the relative predictive power of 4IR on childhood development (cognitive, social, emotional, and physical). The results of the analysis are as follows.

Table 6
Multivariate regression analysis of the Influence of 4IR on Childhood Development

Source	Dependent Variables	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	Cognitive	2825.945[a]	1	2825.945	300.764	.000
	Emotional	307.141[b]	1	307.141	113.014	.000
	Social	160.216[c]	1	160.216	50.679	.000
	Physical	.577[d]	1	.577	.231	.631
Intercept	Cognitive	61480.224	1	61480.224	6543.308	.000
	Emotional	23262.372	1	23262.372	8559.515	.000
	Social	22952.077	1	22952.077	7260.133	.000
	Physical	25168.606	1	25168.606	10083.219	.000
4IR	Cognitive	2825.945	1	2825.945	300.764	.000
	Emotional	307.141	1	307.141	113.014	.000
	Social	160.216	1	160.216	50.679	.000
	Physical	.577	1	.577	.231	.631
Error	Cognitive	15484.433	1648	9.396		
	Emotional	4478.804	1648	2.718		
	Social	5209.963	1648	3.161		
	Physical	4113.554	1648	2.496		
Total	Cognitive	1140272.000	1650			
	Emotional	364753.000	1650			
	Social	341550.000	1650			
	Physical	317182.000	1650			
Corrected Total	Cognitive	18310.378	1649			
	Emotional	4785.945	1649			
	Social	5370.179	1649			
	Physical	4114.131	1649			

Effect	Test Statistic	Value	F	df	Error df	Sig
4IR	Wilks' Lambda	0.836	80.63	4	1645	.000

The results of the multivariate test indicated that 4IR technology had a statistically significant effect on the combined dependent variables, Wilks' $\Lambda = .836$, $F_{(4, 1645)} = 80.63$, $p<0.05$, $\eta^2 = .16$. This suggests that approximately 16% of the variance in the collective childhood development outcomes was explained by 4IR technology. Results equally showed that 4IR exposure had a statistically significant effect on **cognitive development**, $F(1, 1648) = 300.76$, $p < .05$, $\eta^2 = .15$; **emotional**

development, $F(1, 1648) = 113.01$, $p < .05$, $\eta^2 = .06$; and **social development**, $F(1, 1648) = 50.68$, $p < .05$, $\eta^2 = .03$. However, the effect of 4IR on physical development was not statistically significant, $F(1, 1648) = 0.23$, $p = .63$, $\eta^2 = .00$. This aligns with Piaget's theory of cognitive development, particularly the transition into concrete operational thinking during late childhood. Tools like adaptive learning platforms and gamified apps foster problem-solving, logical reasoning, and abstract thinking, all key Piagetian markers of development. This finding supports Vygotsky's socio-cultural theory, where technologies act as "mediational tools" within the Zone of Proximal Development (ZPD). Learners scaffold their understanding through interaction with digital content, peers, and teachers. Prior studies such as D'Amico, 2018; and Liu et al., 2021 have similarly found that when digital technologies are used in structured environments with adult mediation, they enhance attention span, working memory, and cognitive engagement.

However, the regression models showed no significant influence of 4IR on emotional ($\beta = .119$, $p = .906$) and social development ($\beta = .086$, $p = .845$). This outcome reflects broader concerns in the literature. While digital platforms may deliver cognitive content efficiently, they often lack the emotional cues, nuanced feedback, and human connection required for emotional intelligence development. According to Bronfenbrenner's ecological systems theory, child development is deeply embedded in relationships and real-life social contexts, factors that 4IR technologies cannot fully replicate. The low emotional development scores also mirror findings from Limone and Toto (2021), who argue that unsupervised or prolonged digital engagement can reduce empathy, self-regulation, and resilience. Similarly, McCoy (2015) and Cantwell (2020) warn that while digital tools may offer social interaction, they often lack the depth of face-to-face emotional bonding necessary for sustained emotional growth.

Contextually, in the Nigerian school system, especially in basic public schools, digital tools are often introduced without structured emotional learning components. The lack of guided emotional literacy, supervision, or peer-to-peer collaborative activities may explain why learners' emotional development remains unaffected or hindered. Moreover, cultural attitudes toward digital expression and mental health may limit the platforms' utility in developing emotional awareness. Social development outcomes were similarly limited. While technologies offer virtual collaboration spaces, many learners may not have regular access to interactive group tools or may primarily use technology for solitary consumption (YouTube, games). This contradicts the collaborative learning emphasized in Vygotsky's theory and underlines the importance of teacher-guided cooperative tasks to foster peer interaction and teamwork.

Discussion, Conclusion and Suggestions

Findings revealed that most respondents reported that learners sometimes used 4IR technologies, which suggests a moderate integration of these technologies in their

daily activities. Although students are using 4IR tools, this indicates that their routines have not yet fully incorporated their use. This might result from things like restricted access to cutting-edge technological resources, hesitancy on the part of teachers or students to fully embrace digital methods, or doubts over the efficacy of technology in contrast to more conventional teaching methods. The results indicate that although digital tools are being used, they are not yet a preferred or dominating way of interaction. Barriers, including infrastructural issues, digital training, and worries about screen time and social interaction, may need to be addressed to optimise their impact and ensure that technology improves rather than interferes with educational experiences. Haughton (2015) emphasised that young children should use technology in moderation and with balance.

According to a study, basic school students benefited greatly from 4IR regarding cognitive development. 4IR technologies, including virtual reality, artificial intelligence, and adaptive learning platforms, offer immersive, customised learning experiences that are tailored to each student's needs. These tools promote creativity, critical thinking, and problem-solving skills by involving students in lively and interactive activities. Virtual simulations and gamified learning applications, for instance, inspire students to investigate complex ideas practically, which can significantly enhance their comprehension and memory of the material. Brody (2015), Evans (2019), and Kenneth (2017) submitted that technology's frequent and quick visual stimulation may cause developmental brain wiring to change, which could result in less need for imagination and shorter attention spans.

Though the cognitive advantages of 4IR technologies are clear, their effects could differ based on how well they are incorporated into the curriculum and how much assistance is given to teachers and students. For example, students in under-resourced situations are less likely to experience significant cognitive development than students with access to well-designed digital tools and qualified educators. Thus, even if 4IR technologies have a lot of potential to improve cognitive capacities, their use must be matched with all-encompassing teaching methods to guarantee that students acquire diverse capabilities. Kostyrka-Allchorne et al. (2017), Lee et al. (2017), and Uncapher et al. (2017) made the argument that frequent visual stimulation and a decreased need for imagination that are associated with technology use may impede cognitive development.

Also, this study found a moderate extent of social development gained from 4IR by basic school learners, highlighting both the potential and limitations of these tools in fostering social skills. Social learning networks, virtual classrooms, and collaborative online platforms are examples of 4IR technologies that, on the one hand, give students the chance to engage with teachers and peers outside of their immediate physical surroundings. Students can debate ideas, have meaningful conversations, and grow in empathy by learning about other people's viewpoints using online discussion boards and video conferencing. In the digital age, these kinds of encounters can help foster the development of critical social skills.

However, given the moderate level of social development, it is possible that 4IR technologies will not correctly capture the depth of in-person interactions, which are essential for developing strong interpersonal bonds and emotional intelligence. Sometimes, an over-reliance on digital communication technologies results in shallow relationships or a deficiency of non-verbal clues necessary for good communication. Furthermore, social inequality may be exacerbated if certain students lack the required digital literacy to use these tools efficiently or have equitable access. Consequently, even if 4IR technologies present worthwhile chances for social growth, they should be supplemented with conventional, face-to-face activities promoting face-to-face communication and teamwork. The development of critical social skills, including empathy, emotional intelligence, and effective communication, may be hampered by excessive screen time and reliance on technology (Fairlie & Cruz, 2016; Zakaria et al., 2021).

Another finding was that a low level of emotional development was gained from 4IR by basic school learners, exhibiting a significant gap in the holistic development of students in a technology-driven educational environment. Direct human interaction and experiential learning are frequently used to foster emotional development, encompassing self-awareness, empathy, emotional regulation, and interpersonal skills. Virtual reality, artificial intelligence, and online learning platforms are examples of 4IR technologies that are excellent at offering personalised and interactive academic information. For instance, internet interactions lack the subtleties of in-person communication, such as tone of voice and body language, which are essential for recognising and reacting to emotions. Access to resources that support emotional literacy and awareness of emotions can be made possible via educational content and interactive media (Liu et al., 2021). D'Amico's (2018) study concluded that, with sufficient supervision, there is a beneficial association between technology and children's emotional intelligence.

Lastly, the findings in this study reported that basic school learners gained a low level of physical development from the utlisation of 4IR. Physical activities like sports, outdoor play, and experiential learning have long been used to promote physical development, encompassing motor skills, coordination, and general health. In addition to impeding the development of fine and gross motor abilities, prolonged screen time and little physical interaction can also lead to health problems like obesity and bad posture. Virtual simulations, for example, may provide immersive learning experiences. Still, they cannot replace real-world activities like building, playing sports, or sketching, which provide tactile engagement and sensory feedback. Innovative uses of technology, such as gamified physical challenges that stimulate activity or interactive fitness applications, can foster physical development. Excessive technology use can result in sedentary habits, harm children's physical health, and be a factor in a few health problems (Engberg et al., 2019).

This study is limited because participant views and self-reported experiences might not accurately reflect the long-term effects of technology on development,

response bias could be a limitation of this study on the impact of 4IR technologies on learners' development. A small sample size or lack of demographic representation may also have hindered the study, which could have affected how broadly the results can be applied in various educational contexts. The speedy evolution of 4IR technologies is another drawback, which means that the platforms and tools examined in this study might soon become antiquated and reduce the relevance of the results to new developments in the field. Furthermore, the results might have been influenced by external factors that were not fully considered, such as socioeconomic position, access to digital resources, and variations in institutional policy. To provide a more thorough understanding of the impact of 4IR technologies, future research should consider longitudinal studies, a more diverse participant pool, and objective cognitive, social, and physical development measures.

Based on the findings of this study, which revealed a significant positive influence of 4IR technologies on cognitive development but only moderate to low impacts on social, emotional, and physical domains, several integrated recommendations are proposed. To harness the cognitive benefits of digital tools while mitigating their limitations, the government and curriculum development agencies should take the lead in creating and mandating educational content that embeds socio-emotional learning directly into digital platforms. This involves developing educational applications, virtual classrooms, and interactive games that incorporate specific modules designed to promote empathy, emotional regulation, and effective communication, thereby ensuring that technology supports the holistic development of learners rather than cognitive skills in isolation.

Furthermore, to create an enabling environment for this integrated approach, educational administrators must prioritise providing adequate and reliable infrastructural facilities, including stable electricity and internet connectivity, which are foundational for the effective adoption of 4IR technologies in teaching and learning. Schools should also actively promote technologies that support physical well-being, such as interactive learning games and fitness applications that encourage movement and exercise, thereby strategically blending virtual and physical learning experiences to advance cognitive and physical development.

The critical role of human guidance in the digital ecosystem cannot be overstated. Teachers, parents, and guardians must be equipped to guide learners in online mental well-being, including educating students on managing digital interactions responsibly, understanding the social and emotional implications of technology use, and fostering the principles of positive digital citizenship. Finally, teachers require continuous professional development that moves beyond basic digital literacy for teachers to implement these strategies effectively. Regular training programmes should focus on leveraging 4IR tools for cognitive instruction and as a means to actively enhance learners' emotional intelligence, social collaboration, and physical health, ensuring they are prepared to facilitate holistic growth in a technology-driven educational landscape.

The results of this study have significant ramifications for curriculum development, education policy, and digital literacy programs. Given the beneficial effects on cognitive development, educators should incorporate 4IR technology into classrooms to improve students' thinking ability and problem-solving skills. However, the detrimental impact on social development emphasises balancing digital and in-person connections to avoid social isolation. The study also raised concerns over physical health, highlighting the significance of ergonomics and appropriate screen time management. When creating frameworks for technology-driven education, policymakers must consider these findings to ensure that digital technologies improve learning while addressing any potential adverse effects.

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Dördüncü Sanayi Devrimi (4IR) Teknolojilerinin Nijerya'daki Temel Eğitim Öğrencilerinin Gelişimi Üzerindeki Etkisinin Değerlendirilmesi

MAKALE TÜRÜ	Başvuru Tarihi	Kabul Tarihi	Yayın Tarihi
Araştırma Makalesi	17.04.2025	03.09.2025	15.12.2025

Adesegun Olayide Odutayo[1]
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Öz

Nijerya toplumunda genç nesil arasında depresyon ve siber zorbalık vakalarında artış gözlemlenmekte olup, bu durum yoğun teknoloji kullanımına bağlanmakta ve çocuk gelişimi üzerindeki etkileri konusunda endişeler duyulmaktadır. Bu çalışma, Nijerya'daki temel eğitim öğrencileri arasında 4. Sanayi Devrimi (4IR) teknolojilerinin öğrencilerinin gelişimlerinin çeşitli boyutları üzerindeki etkisini araştırmaktadır. Araştırmada betimleyici tarama yöntemi kullanılmıştır. Gelişim ve sosyo-kültürel öğrenme teorilerine dayanan bu çalışma, Ogun Doğu Senato Bölgesi'ndeki 160 okulda öğrenim gören 2.400 Beşinci Sınıf öğrencisi ile gerçekleştirilmiştir. Veriler, araştırmacı tarafından hazırlanan ve geçerliliği sağlanmış anket aracılığıyla toplanmış, yüzde, genel ortalama ve çoklu regresyon analizleri ile değerlendirilmiştir. Anketin güvenilirliği test-tekrar test yöntemi ile ölçülmüş ve Pearson Momentler Çarpımı Korelasyon (PPMC) ile 0,83 güvenilirlik indeksi elde edilmiştir. Bulgular, 4IR teknolojilerinin bilişsel gelişim üzerinde istatistiksel olarak anlamlı bir etkiye sahip olduğunu göstermiştir ($\beta = .360$, $p < .001$); bu da dijital araçların öğrencilerin hafıza, dikkat ve problem çözme becerilerine olumlu katkı sağladığını işaret etmektedir. Ancak, duygusal, sosyal ve fiziksel gelişim alanlarında anlamlı bir etki gözlemlenememiş, bu durum yapılandırılmamış veya denetimsiz dijital maruziyetin bütünsel gelişim üzerindeki sınırlamalarını ortaya koymuştur. Araştırmanın bulguları, Nijerya'daki temel eğitim programlarına sosyo-duygusal öğrenme ve öğretmen rehberliğinde dijital etkileşimin entegre edilmesini öngören eğitim politikalarının önemini vurgulamaktadır.

Anahtar sözcükler: Dördüncü Sanayi Devrimi, Nijerya temel eğitim sistemi, teknoloji ve çocuk gelişimi, dijital öğrenme, eğitimde teknoloji entegrasyonu, dijital okuryazarlık.

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References

Akintola, M. A., Adebayo, A. A., & Odutayo, A. O. (2025). Innovative Strategies for Integrating Entrepreneurship into Teacher Education: A Systematic Review. Ilorin Journal of Education, 45(2), 306–321. https://ije.unilorinedu.sch.ng/index.php/ije/article/view/257

Alotaibi, T., Almuhanna, R., Alhassan, J., Alqadhib, E., Mortada, E., & Alwhaibi, R. (2020). The relationship between technology use and physical activity among typically-developing children. Healthcare (Basel, Switzerland), 8(4), 488-494. https://doi.org/10.3390/healthcare8040488

Baaitjies, R. (2019). The 4th Industrial Revolution: Implications for 21st century local governance, Transformer Journal, 20(1), 56-65.

Brody, J. (2015). Screen addiction is taking a toll on children - The New York Times. Retrieved from https://well.blogs.nytimes.com/2015/07/06/screen-addiction-is-taking-a-toll-onchildren/?_r=0

Cantwell, A. (2020). Impact of internet on the social interaction of k12 children. Journal of Counselling, 15(1), 68–76. https://doi.org/10.751/6292.003.0003

Chukwu, C. (2018). Joint attention in the development of child's interaction. Science of Development, 27, 62–81.

Cooke, J. E., Kochendorfer, L. B., Stuart-Parrigon, K. L., Koehn, A. J. & Kerns, K. A. (2019).Parent–child attachment and children's experience and regulation of emotion: A meta-analytic review. Emotion, 19(6), 1103-1126. https://doi.org/10.1037/emo0000504

Corfe, S. (2019). Tech in the town: How the Fourth Industrial Revolution could transform local government, Social Market Foundation. Retrieved from http://www.smf.co.uk/wp-content/uploads/2019/05/Tech-in-the-Town.pdf

D'Amico, A. (2018). The Use of Technology in the promotion of children's emotional intelligence: The multimedia program "developing emotional intelligence". International Journal of Emotional Education, 10(1), 47-67.

Ebunoluwa, R. (2017). The impact of digital technologies on child wellbeing. Minet Publisher.

Engberg, E., Figueiredo R. A. O., Rounge T. B., Weiderpass E., Viljakainen H. (2019). Heavy screen users are the heaviest among 10,000 children. Sci. Rep., 9, 1-6. https://doi.org/10.1038/s41598-019-46971-6

Evans, M. (2019). The influence of television on cognitive development and educational achievement. [Unpublished Ph.D. Thesis], Nnamdi Azikiwe University, Awka.

Fairlie, R. W. & Cruz, S. (2016). The effects of computers on children's social development and school participation: evidence from a randomized control experiment. Discussion Paper No. 10398, Retrieved from https://docs.iza.org/dp10398.pdf

Gottschalk, F. (2019). Impacts of technology use on children: Exploring literature on the brain, cognition and wellbeing. OECD Education Working Paper No. 195. Retrieved from https://one.oecd.org/document/EDU/WKP%282019%293/En/pdf

Hardell, L. (2018). Effects of mobile phones on children's and adolescents' mental health: A commentary. Child Dev., 89, 137–140

Hong, N., & del Busto, C. T. (2020). Collaboration, scaffolding, and successive approximations: A developmental science approach to training in clinical psychology. Training and Education in Professional Psychology, 14(3), 228.

James, D. (2020). Motor development leads to changes in visual processing in the childhood brain. Science Developmental, 31, 88-97.

Johnson, M. (2019). Computers in the family context: Perceived impact on family time and relationships. Family Review, 23(1), 23–35.

Jules, T. D. (2017). Public policy and governance. the global educational policy environment in the fourth industrial revolution: Gate, regulated, and governed. Emerald Group Publishing Limited. https://doi.org/10.1108/s2053-7697201726

Komolafe, Y. (2018). An analysis of technology on cognitive outcomes among children and adolescents. [Unpublished Masters Dissertation], Abia State University, Abia State.

Kostyrka-Allchorne, K., Cooper, N. & Simpson, A. (2017). The relationship between television exposure and children's cognition and behaviour: A systematic review. Developmental Review, 44(1), 67-78. http://doi.org/10.1016/j.dr.2016.12.002

Lee, E., Spence, J. & Carson, V. (2017). Television viewing, reading, physical activity and brain development among young South Korean children. Journal of Science and Medicine in Sport, 20(7), 672-677. http://doi.org/10.1016/J.JSAMS.2016.11.014

Limone, P. & Toto, G. A. (2021). Psychological and emotional effects of digital technology on children in COVID-19 pandemic. Brain Sci., 11, 11-26. https://doi.org/10.3390/brainsci11091126

Liu, W., Tan, L., Huang, D., Chen, N., & Liu, F. (2021). When pre-schoolers use tablets: The effect of educational serious games on children's attention development. International Journal of Human–Computer Interaction, 37(3), 234–248. https://doi.org/10.1080/10447318.2020. 1818990

Loes, C. N. & Saichaie, K. (2016). Cognitive effects of technology over four years of college. Journal for the Study of Postsecondary and Tertiary Education, 1,181-196. https://doi.org/10.28945/3506

McCoy, T. (2015). Researchers: Using an iPad or smartphone can harm a toddler's learning and social skills. Washington Post. Retrieved from http://www.washingtonpost.com/news/morning-mix/wp/2015/02/02/usingan-ipad-or-smartphone-can-harm-a-toddlers-brain-researchers-says/

McLeod, S. (2024). The Concrete Operational Stage of Cognitive Development. Simply Psychology. https://www.simplypsychology.org/concrete-operational.html

Odutayo, A. O. & Fonseca, K. (2024). Making quadratic functions interesting: Students teams-achievement division instructional strategy. EURASIA Journal of Mathematics, Science and Technology Education, 20(1), 1-11. https://doi.org/10.29333/ejmste/14092

Odutayo, A. O. & Ramsaroop, S. (2023). Experiences of Student-Teachers: Implications for Refined Student-Support. International Journal of Learning, Teaching and Educational Research, 22(7), 87–103. https://doi.org/10.26803/ijlter.22.7.5

Odutayo, A. O., Adebayo, A. A. & Adewuyi, H. O. (2024). Teachers' management of everyday-living skills of intellectually challenged learners. Indonesian Journal of Early Childhood Education Studies, 13(2), 126-143. https://doi.org/10.15294/ijeces.v13i2.283

Oswald, T. K., Rumbold A. R., Kedzior S. G. E., & Moore V. M. (2020). Psychological impacts of "screen time" and "green time" for children and adolescents: A systematic scoping review. PLoS ONE, 15, 23-27. https://doi.org/10.1371/journal.pone.0237725

Pérez-Edgar, K. (2019). Through the looking glass: Temperament and emotion as separate and interwoven constructs. In: LoBue V, Pérez-Edgar K, Buss K, eds. Springer. https://doi.org/10.1007/978-3-030-17332-6_7

Peters, M. A. (2017). Technological unemployment: Educating for the Fourth Industrial Revolution. Journal of Self-Governance and Management Economics, 5(1), 25-33. https://doi.org/10.22381/JSME5120172

Saarinen, A., Lipsanen, J., Hintsanen, M, Huotilainen, M. & Keltikangas-Järvinen, L. (2021). The use of digital technologies at school and cognitive learning outcomes: A population-based study in Finland International Journal of Educational Psychology, 10(1), 1-26. https://doi.org/10.17583/ijep.2021.4667

Sherman, L. E., Greenfield, P. M., Hernandez, L. M., & Dapretto, M. (2018). Peer influence via instagram: effects on brain and behavior in adolescence and young adulthood. Child development, 89(1), 37–47. https://doi.org/10.1111/cdev.12838

Siregar, A. O. & Yaswinda, Y. (2021). Impact of gadget use cognitive development. Advances in Social Science, Education and Humanities Research, 668, 168-172. https://doi.org/10.2991/assehr.k.220602.035

Uncapher, M. R., Lin, L., Rosen, L. D., Kirkorian, H. L., Baron, N. S., Bailey, K., Cantor, J., Strayer, D. L., Parsons, T. D. & Wagner, A. D. (2017). Media multitasking and cognitive, psychological, neural, and learning differences. Pediatrics, 140(Suppl 2), 62-66. https://doi.org/10.1542/peds.2016-1758D

Unicef (2014). Early childhood development: The key to a full and productive life. UNICEF. Retrieved from http://www.unicef.org/dprk/ecd.pdf

Yusuf, H. T., Akintola, M. & Odutayo, A. O. (2018). Lecturers' readiness towards the integration of social media for teaching in a Nigerian University. International Journal for Innovative Technology Integration in Education (IJITIE), 1(1), 56-64. https://ijitie.aitie.org.ng/index.php/ijitie/issue/view/3

Zakaria, M. Z., Yunus, F., & Mohamed, S. (2021). Drawing activities enhance preschoolers' socio emotional development. Southeast Asia Early Childhood Journal, 10(1), 18–27. https://doi.org/10.37134/saecj.vol10.1.2.2021

Appendices

QUESTIONNAIRE ON ASSESSING THE INFLUENCE OF 4IR TECHNOLOGIES ON CHILDHOOD DEVELOPMENT

Dear Respondent,

You are requested to supply information on the influence of 4ir Technologies on childhood development. Your honest and unbiased opinion about the requested information will contribute to improving academic research writing. Kindly supply the required information in the spaces provided. Your responses shall be treated with utmost confidence, as you are not required to indicate your name.

SECTION A: Background Information

DIRECTIONS: Please tick (√) the box corresponding to your choice(s) or write the requested information concerning each statement below.

Gender: Male ( ) Female ( )

School Name: ……

School Type: Public [ ] Private [ ]

School Location: Urban [ ] Rural [ ]

Educational Qualifications: Ph.D. [ ] M.Ed./M.Sc./M. A.[ ] B.Sc./B.A./B.Sc.(Ed.)/B.A. (Ed.)/B.Ed. [ ] HND [ ] OND [ ] SSCE [ ]

Years of Teaching Experience: 0-5 Years [ ] 6-10 Years [ ] 11-15Years [ ] 16 Years and above [ ]

SECTION B:

Kindly respond to the statements below using the following keys:

Always= A; Sometimes= S; Rarely = R; Never= N

	4IR Technology	A	S	R	N
1	I use digital devices in every activity I engage in.				
2	I make use of educational apps to promote my learning.				
3	I am very comfortable navigating and using different technologies.				
4.	My school endeavours to allow me to make use of technology to promote learning				
5	My parents allow me to make use of technology for purposes other than learning or academic purposes.				

SECTION C:
Kindly respond to the statements below using the following keys:
Strongly Agree= SA; Agree= A; Disagree= D; Strongly Disagree= SD

	Cognitive Development	**SA**	**A**	**D**	**SD**
1	4IR technologies enhances my creativity skills				
2	Spending time on 4IR technologies fosters my memory and critical thinking abilities				
3	4IR technologies positively influences my ability to process information and learn.				
4	My cognitive development has been sizable due to sufficient balancing between 4IR technologies and other non-digital activities				
5	4IR technologies improves my attention span				
6	My problem-solving skill improves with the use of 4IR technologies.				
	Social Development				
1	Balancing 4IR technologies with other face-to-face social activities positively supports my overall social development.				
2	Engaging in social media or other digital platforms is allowing me to believe in myself				
3	Frequent use of 4IR technologies promotes healthy social abilities.				
4	I frequently adopt 4IR technologies as the primary means of interacting with friends, peers, and family, which enhances my social skills.				
5	Online communities and digital platforms do not negatively influence my ability to connect with others face-to-face.				
6	Online group activities or educational apps enhance my ability to collaborate and work in teams.				

7	Prolonged use of 4IR technologies does not negatively impact my face-to-face social interactions.				
8	Proper supervision of online interactions ensures my safety				
	Emotional Development				
1	4IR technologies positively impact my emotional literacy and understanding of emotions.				
2	Exposure to specific content through 4IR technologies (e.g., social media, videos) does not negatively affect my emotional wellbeing.				
3	Interactive learning platforms and educational apps enhance my emotional engagement and learning motivation.				
4	My emotional expressions or mood can improve using 4IR technologies.				
5	Putting myself and understanding other people's perspectives is improving using 4IR technologies.				
6	Supervising my screen time ensures a healthy balance and supports my emotional development.				
7	There have been potential drawbacks or adverse effects on my emotional development by using 4IR technologies.				
8	Using 4IR technologies allows me to cope with stress or challenging situations.				
	Physical Development				
1	Constant use of 4IR technologies positively influences my physical fitness and overall health.				
2	Extended usage of 4IR technologies affects my posture and musculoskeletal health.				
3	I feel fatigued and have eye strain after excessive use of 4IR technologies.				
4	Inadequate regulation of the use of 4IR technologies positively influences my physical development.				

5	My interest in outdoor play and physical exploration is not reducing due to my addiction to 4IR technologies.				
6	My level of physical activity is not reducing due to regular usage of 4IR technologies.				
7	My sleep patterns are not disrupted because of the excessive use of 4IR technologies.				

Ethical and Author Declarations | Etik ve Yazar Beyanları

Authors' Contributions

All stages of the study were carried out solely by the author.

Conflict of Interest

There are no financial or personal conflicts of interest that could have influenced the study.

Ethical Approve

The planning and implementation of this research were approved by the Faculty of Education Research Ethics Committee of the University of Johannesburg, South Africa, with the decision dated 03.18.2024 and numbered SEM-2-2023-068.

Use of Artificial Intelligence

Only the QuillBot tool was used in this study to make formal adjustments to expressions. Apart from this, no other artificial intelligence tools were used during the writing, analysis, or data processing stages of the research. The author takes full responsibility for the entire academic content of the study.

Yazarların Katkı Düzeyleri

Bu çalışmanın bütün aşamaları yazar tarafından yürütülmüştür.

Çıkar Çatışması Beyanı

Çalışmayı etkileyebilecek herhangi bir mali veya kişisel çıkar çatışması bulunmamaktadır.

Etik Onay

Bu araştırmanın planlanması ve yürütülmesi, Johannesburg Üniversitesi Eğitim Fakültesi Etik Kurulu'nun 18 Mart 2024 tarihli ve SEM-2-2023-068 sayılı kararıyla etik açıdan uygun bulunmuştur.

Yapay Zeka Kullanımı

Bu çalışmada ifadeleri biçimsel olarak yeniden düzenlemek amacıyla yalnızca QuillBot aracı kullanılmıştır. Bunun dışında, araştırmanın yazım, analiz veya veri işleme aşamalarında başka herhangi bir yapay zekâ aracı kullanılmamıştır. Çalışmanın tüm akademik içeriği yazarın sorumluluğundadır.

This study has been evaluated under double-blind peer review and verified to be free of plagiarism using iThenticate software.
Bu çalışma, çift taraflı kör hakemlik kapsamında değerlendirilmiş ve iThenticate yazılımı kullanılarak intihal içermediği teyit edilmiştir.

Ethical disclosure | Etik bildirim: ebfd@ankara.edu.tr