Original Research Article

The Role of Artificial Intelligence in Shaping Cognitive and Social Development among School-Going Children in Uttar Dinajpur District, West Bengal

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Abstract: The study is concerned with how AI affects the mental and social development of children who go to school in the Uttar Dinajpur District, West Bengal, India. The study, as a consequence of the rising use of AI-tool in education, measures the effect of different technologies like intelligent tutoring system, AI-based application, etc. on children logical thinking, emotional quotient, and interaction. The study was adopted a quantitative research design, wherein a sample size of 150 (Male-80, Femle-70) students was drawn through stratified random sampling. A self-made questionnaire was used in this study and the data was collected partly through google form and partly in person and regression analysis were employed to validate the two hypotheses. The results revealed that the use of AI-based tools for educational purposes leads to a significant cognitive development (β = 0.149, p = .000), whereas social and emotional development is greatly impacted by the engagement with AI-driven applications (β = 0.497, p = .000). Moreover, the study found that AI is a potential educational assistant if the implementation is done thoughtfully and as well as ethically. However, there is a call for the importance of ensuring that the use of technology is accompanied by real-world social interactions to enable the all-round development of school going children.
Keywords: Artificial Intelligence, Cognitive Development, Social Behavior, School-Going Children, Educational Technology.

1. INTRODUCTION

Artificial intelligence conveys the concept of a fastest workstation, a machine along with extraordinary operating power, encompassing adaptive behaviours, like sensor integration and other functionalities, which facilitate human-like cognition and capabilities, thereby enhancing its interaction with humans (Nair 2024). The education industry has seen an expanded utilisation of artificial intelligence, transcending the common knowledge of AI as a fasted computer that involved embedded (Chen *et al.,* 2020). The Artificial Intelligence be aware of mighty positivity impacts to immature students' academic and cognitive performance. AI applications like digital teaching methods and rational teaching methods, it can make a student humble and independent educational performance (Roman 2024). Such as unique direction able to improvement the learning process and make kids find the material easier to get (Pathan *et al.,* 2023).

AI-driven technologies are being used to make digital content and services more attractive to young children. These interfaces utilize different human-computer interaction modalities, that is, gestures, touch, and speech, with the aim to make it easy for children to use technology. More so, they allow children who have limited reading or typing skills to interact with digital devices efficiently. Gestures like "swiping, tapping or waving" may make it easier for one to move within apps or games (Zhai *et al.,* 2024). These actions do not take users back to the old way of using their gadgets but rather provide more then active and intuitional pathway for them to use their gadgets (Li & Lee 2025). AI significantly influences children's social skills with the help of tech. It can provide them with a virtual assistant who can be a part of their social life and thus boost their confidence and communication skills. As an example, children who form parasocial relationships with AI characters or robots not only get emotional support but also are becoming faster and more motivated while

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playing educational games, according to a number of studies (Masih *et al.,* 2025). All this interaction can be a form of social reinforcement and providing help which would be both positive aspects in the social-emotional skills and the learning (Lala & Hagishima, 2022).

AI has a multitude of positive effects on the cognitive and social improvement of school students, and the scope of these effects keeps on changing. If properly planned and executed in line with educational principles and moral standards, AI could be a great tool for learning, creativity, and social skills development as well (Gupta *et al.,* 2025). Nevertheless, AI cannot offer the wide range of human communication necessary for the complete growth of a child, particularly in areas such as language, emotional intelligence, and social skills. To really get the most out of AI and lessen the risk of harm, children, educators, and developers must be equipped with critical AI literacy so that children can critically assess the information supplied by AI and thereby have a balanced and healthy cognitive and social development (Meyer 2024).

1.1 Cognitive Development in School-Going Children

School children's cognitive development is a process that is typical in most cases and is arranged in stages according to the famous developmental psychologist Jean Piaget. After a short period of time when the kids were infants and toddlers, children grow till they become of school-age, which is the period that roughly covers ages from 6 to 12 years, and mainly corresponds to the beginning of the actual operational periods and formal operational stag (7-11) in early adolescence by Piaget (McLeod 2025). In the concrete operational stage, kids acquire logic skills that they can apply to the objects and events around them. They learn through and eventually master concepts such as conservation (the idea that the amount remains the same even if the shape and the appearance have changed), reversibility (the mental ability to go back on an action), classification (the process of grouping objects that have one or more attributes in common), and seriation (the arrangement of objects by size or number gradually).

Around the ages of 11 to 12 and onward, as children develop into the formal operational stage, they acquire the abilities to think abstractly, scientifically reason, develop hypotheses, and consider hypothetical scenarios and moral reasoning (Mph 2024). This is a progression towards adolescent cognitive development (Jade 2025). The cognitive development in the school environment is reflected in various ways like the increasing vocabulary, longer attention spans, improved problem-solving skills, better reasoning about time, money, fractions, and the ability to express complex thoughts and feelings (MSEd 2024). Kids become more inquisitive, gain more confidence, and also enhance their capacity for independent learning and take up more responsibility. The cognitive development in school-going children is depicted by a change from concrete, literal thinking to more logical and increasingly abstract thought, which facilitates them to interact effectively with the academic content and the social context (Malik & Marwaha 2023).

1.2 Social Development and Peer Interactions

Social development in school-age children is mainly through the practice of independence, peer relationships and social-emotional skills. In this age group, children start to look more into friendships and peer acceptance, thus a best friend relationship is formed very often (Malik & Marwaha 2018). They get the skills of cooperating, sharing, taking turns, and managing their emotions more effectively. Peer groups become the most important part of their social world, and they start to feel the pressure of peers and deal with more advanced social situations such as teamwork, conflicts, and role-playing. Namely, kids between 6 and 8 years old become more independent from family, pay more attention to friendships, and want to be accepted by their peers.

On the other hand, by the time they are 9 to 11 years old, friendships become deeper and more emotionally significant, most of the time with same-gender peers only. The kids might become more socially aware, they could understand the consequences of their actions, and they might even show empathy towards others. In late childhood, children tend to control their behavior and feelings more and more self-regulation, demonstrate the expanding abilities of social rules comprehension, and become aware of the pride and confidence of their social and academic successes (Longobardi *et al.,* 2018). Social skills can be fostered by parents and teachers through the means of initiating positive peer relationships, being the role model in self-regulation, setting up rules that are both clear and consistent, giving rewards to correct behaviors, and creating situations for group play and community participation (Maunder 2018).

2. REVIEW OF RELATED LITERATURE

The cognitive impairment linked to depression in school-aged children. Depression and cognitive dysfunction exhibited a shared pathophysiology in brain regions involved in emotional and cognitive processing, potentially influenced by hereditary and environmental factors. The school years were crucial periods during which the brain developed, and the foundation of information and critical thinking skills expanded. Depression and other mental illnesses frequently commenced prior to the completion of individuals' educational pursuits. Challenges with attention, concentration, and cognition significantly hindered academic performance, leading even formerly high-achieving students to feel disheartened by missed time and deteriorating results. (Pandey, *et al.,* 2014). The influence of "Artificial Intelligence" (AI) on education. Artificial intelligence was a discipline that focused on the breakthroughs and advancements that enabled

computers, machines, and other entities to exhibit human-like intelligence, defined by cognitive abilities, learning, adaptability, and decision-making skills. AI had originally manifested as computer and related technologies, evolved into web-based intelligent educational systems, and ultimately incorporated embedded computer systems, alongside other technologies, to utilise humanoid robots and web-based chatbots for executing instructional duties autonomously or in collaboration with educators (Chen, *et al.,*2020). Artificial Intelligence in Education (AIED) as a significant corpus of literature that encompassed various viewpoints. This study provided mainly 3 essential doubts: Describe the main elements of AI software examined in the field of education? What are the main research titles and which were the meaningful judgments? This study emphasised the variety of ideas utilised AI in education writers, the multidimensional character of reproducing places also incompetently the fields of education. This study provided significant visions for researchers to understand the landscape of AI in educational research also to pinpoint Predictions for additional research in this improving field (Shan. Wang., *et al.,* 2022). Examined the possible influence of AI on education by reviewing and analysing the available writing over 3 primary dimensions: supplications, benefits, and obstacles. ChatGPT's brilliant performance across multiple standardized academic tests boosted the debate about the performance of AI in education beyond the traditional scope. The study looked into the use of AI in collaboration between teacher and learner, the development of smart tutoring systems, the facilitation of learning through automation, and the customization of education. The investigation also focused on the hazards, moral issues and foreseen future trends concerning the utilizations of AI in the field education (Kamalov, *et al.,* 2023). Analysed the influence of Artificial Intelligence on educational processes, elucidating the potential of AI for student-cantered knowledge, prospectus expansion, and educator training. AI-led machines had allowed personalized learning journeys, resulting in the progress of school children's logical thinking and problem-solving ability Students' social ability and deep-thinking skill were influence by the workers of Artificial Intelligences in students' life. The marked lined how tough it for guardian and tutors to manage perfectly leading, (Ahmad Pathan & Asad Ali Kanth 2023). Impact of students' excessive dependence on technologies, especially such persons who utilising generative models for research fields and Investigating attention on students' cognicional skill, critical thinking, with logical perceptive and decision making. The overuse of AI became so prominent that users blindly accepted the recommendations given by AI without verifying them, which led to mistakes in the decision-making process in such contexts. The results revealed that the problem of dependence on AI because of ethical concerns led to the decrease of human cognitive capabilities as people were inclined to choose quick and perfect solutions rather than slow and more practical ones. (Zhai, *et al.,* 2024). The

assembly among students' ongoing cognitive progress and their utilize of digital devices. Consequently, the study delved into the mental and behavioral repercussions, which included self-concept, affective regulation, and dysfunctional behaviors related to overuse of screens. The results made a significant contribution by providing guidelines for parents, teachers, and policymakers, suggesting the 'right' use of technology that promotes children's intellectual growth, along with the prevention of the downsides. The study provided important clues to all parties involved in the care, education, and policy of the child, pointing to the need to integrate digital tools in a balanced manner in early learning environments. (Clemente, *et al.,* 2024). Impact of artificial intelligence on the well-being of students and academics in tertiary education. AI had given the green light to education through the application of technology, the provision of mental health support, and the improved efficiency of communication; on the other hand, it had also led to problems such as digital fatigue, loneliness, technostress, and decreased face-to-face interaction. Over-reliance on AI led to the gradual disappearance of interpersonal and emotional skills among which caused social isolation and anxiety. In this study, the requirement of equally implemented AI, which would not only support academic progress but also student welfare, was accentuated, (Klimova, B., & Pikhart, M. 2025). Focused on AI, Mind and Teen-ager (ABC), an open to all journal, is committed toward the detailed examination of the intricate relationship of AI, neuroscience, and child education. The study explored the various functions of AI and neuroscience in children's cognitive, community, and sensitive development, through promotion interdisciplinary conversation between educators, academics, clinicians, and representatives. The goal of the research was to open up access to top-notch studies, dealing with both the beneficial uses and the ethical issues related to AI and neuroscience technology. The platform was also looking to provide the most reliable sources for educational reform and to solve key developmental and educational issues, (Li & Lee (2025). The different effects of Artificial Intelligence on the young, such as cognitive growth, social relations, and the ethical implications. It utilized an interdisciplinary methodology to probe how the integration of AI technology had changed the behaviors, relationships, and general well-being of adolescents. The study went into depth about the influence of AI on the young, highlighting the potential AI's recompenses and problems of technology adoption in their exists. The study not only strongly advocated for the development of ethical AI but also offered suggestions on how to ease the negative effects while increasing the positive effects of AI on adolescent growth. (Gupta, 2025). Deep learning in school-level children should become a key educational goal to tackle AI's extensive submission in education. The rise of AI changed the world we live in; schools had to adapt to new teaching methodologies that focus on giving students the skills they need to be active and critical thinkers rather

than mere rote learners and passive knowledge consumers. Depth knowledge characterised through critical thinking, information combination, creative investigation, and practical application, contrasted with superficial engagement and became increasingly essential in AI-enhanced learning settings, (Doan *et al.,* 2025)

3. RESEARCH GAP

A large research gap exists in investigating the influence of AI on the cognitive and social development of school-age children, especially concerning the long-term effects and the subtle interaction between AI and human contact. On one side, the researchers have already identified the potential good sides and difficulties of AI use in education. However, the downside is a lack of the deep-diving studies that would deal with the issue of how AI-driven tools and environments develop children's cognitive and social skills during the course of time, particularly when compared with the traditional learning methods and in different settings. This research delves into the outstanding questions, benefits, and obstacles of the use of Artificial Intelligence (AI) in the educational domain—essentially, areas such as personalized learning, smart tutoring systems, and the improvement of cognitive abilities. Nevertheless, there is a significant distance between the presence of such a gap and the focus of the existing empirical research concerning the combined impact of AI on cognitive and social development of school-going children. Most of the existing research works either focus on the achievements related to school performance or cognitive abilities treated as separate. By that time, children's social behaviours, emotional intelligence, and peer engagement during the first years of life are considered underdeveloped. Those which are AI-based and aimed at kids are usually left unnoticed as a source of children's

socialization, emotional intelligence, and peer interaction during the formative years. This study is designed to fill this significant gap by considering how tech-based education, AI-powered devices, and different programs change not only the intelligence of school children but also their social and emotional characteristics in the long run. Also, these factors are shaping a more comprehensive AI developmental implication pattern.

4. METHODS AND MATERIALS

In this study explored the impact of Artificial Intelligence on cognitive and social development among school-going children in Uttar Dinajpur District, West Bengal, India. The researchers followed a descriptive and exploratory research design using a sample size of 150 (Male 80, Female-70) of school going children through stratified random sampling technique. The study utilised a self-made questionnaire to measure independent variables such as AI-enabled educational tools and exposure to AI-driven applications, and it has also employed statistical applications like MS Excel and SPSS.

5. RESEARCH OBJECTIVES

I. To assess the impact of AI-enabled educational tools on the cognitive development of students.
II. To evaluate the influence of AI-driven applications on children's social behaviors and emotional intelligence.

6. RESEARCH HYPOTHESIS

H_1: There is a significant impact of AI-enabled educational tools on the cognitive development of students.
H_2: AI-driven applications significantly influence children's social behaviors and emotional intelligence.

7. RESULT

Table 1: Demographic Variables

S. No.	Demographic Characteristics		N	%
1	Age	6–8 Years	47	31.30%
		9–11 Years	26	17.30%
		12–14 Years	38	25.30%
		15–17 Years	39	26%
2	Gender	Male	80	53.30%
		Female	70	46.70%
3	Class Level	Class 1–3	47	31.30%
		Class 4–6	33	22%
		Class 7–9	37	24.70%
		Class 10–12	33	22%
4	Type of School	Government	30	20%
		International	34	34%
		Government-aided	45	30%
		Private	41	27.30%
5	Access to Digital Devices at Home	No access to digital devices	44	29.3
		Personal device	44	29.3
		Shared device	62	41.3

6	Frequency of Internet Use	Less than 1 hour	39	26%
		1–2 hours	27	18%
		3–4 hours	42	28%
		More than 4 hours	42	28%

The demographic data shows that the largest group of respondents (31.3%) are children between the ages of 6 and 8 years, with other age groups being more or less evenly distributed. The gender data indicates that there are 53.3% of males, which means that the male group is just slightly bigger than the female one. The different school years have been almost equally represented, with the majority of children being in the 1st, 2nd, and 3rd Grades (31.3%). As per the discussion about school type, it could be inferred that the students are from schools which are either government-aided (30%) or private (27.3%). However, a large percentage of the students (34%) are attending international schools. Looking at the distribution of digital devices among students, it seems that most of them (41.3%) are using shared devices, while only 29.3% have personal access and the same number do not have access at all. Moreover, the internet usage data reveal that most of the students (28%) use the internet for 3 to 4 hours or for more than 4 hours daily (28%), which means that nearly two-thirds of the respondents are very actively digitally-engaged.

Objective 1: To assess the impact of AI-enabled educational tools on the cognitive development of students.

H₁: There is a significant impact of AI-enabled educational tools on the cognitive development of students.

Table 2: Regression Table

Hypothesis	Regression Weights	Beta Coefficient	R2	F	t-value	p-value	Hypothesis Result
H₁	Usage of AI-enabled educational tools> Cognitive development indicators	.149	.149	3.362	7.233	.000	**Supported**

Table 2 shows results from a regression study related to Hypothesis H1 which seeks to understand the influence of AI-enabled educational tools on cognitive development indicators. A regression weight ($\beta = 0.149$) illustrates a positive association with an R² value of 0.149 showing that the usage of AI tools can account for about 14.9% of the change in cognitive development. An F-value of 3.362 and a very significant p-value (.000) are given, thus verifying the statistical validity of the model. The t-value of 7.233 also adds to the closeness of the association. Hence, the statement is true, and it is shown that the use of AI-enabled educational tools is a significant and effective way to the cognitive development of students.

Objective 2: To evaluate the influence of AI-driven applications on children's social behaviors and emotional intelligence.

H₂: AI-driven applications significantly influence children's social behaviors and emotional intelligence.

Table 3: Regression Table

Hypothesis	Regression Weights	Beta Coefficient	R2	F	t-value	p-value	Hypothesis Result
H₂	Exposure to AI-driven applications> Social behaviors and emotional intelligence	.497	.497	48.665	6.286	.000	**Supported**

Table 3 shows the regression analysis for Hypothesis 2 that reveals the relation between the use of AI-driven applications and the aga development of social behaviors and emotional intelligence. The regression weight ($\beta = 0.497$) is indicative of a strong positive association, and the R² value of 0.497 shows that almost half (49.7%) of the changes in social behavior and emotional intelligence can be accounted for by the exposure to AI applications. The statistics are combined in such a way that the F-value of 48.665, the t-value of 6.286, and the associated p-value of .000 all point to the model being statistically significant. Consequently, the hypothesis can be considered as true, which means that the exposure to AI is found to be a major factor in students' social and emotional development.

8. DISCUSSION

The conversation reflects through the empirical findings of the study that Artificial Intelligence (AI) is a major contributor to the cognitive and social development of children attending school. The employment of AI-empowered educational resources has been reported to have a favourable influence on the cognitive development through the promotion of critical thoughtful, situation managing skills, and individualized learning ability, (Pathan., 2023; & Chen *et al.,* 2020). The study, moreover, synthesizes that the application of AI substantially influences the social behaviors of children's and emotional intelligence, suggesting through better communication, empathy, and interactive

engagement (Roman, 2024; & Munzer, 2024). Nevertheless, scholars like Zhai et al. 2024)alert about the possible disadvantages of AI overuse which may lead to digital dependency, technostress, and weakened interpersonal skills. The exchange accentuates that although AI has revolutionary possibilities, its execution should be balanced and morally led with the involvement of educators and parents taking the responsibility of alleviating the dangers and nurturing overall growth (Gupta, 2025; & Masih *et al.,* 2025).

9. CONCLUSION

The study conclude that the influence of Artificial Intelligence is huge and it actually helps to lift the cognitive and social development of the children going to school, mainly in the digital world context of educational institutions in big cities such as the Uttar Dinajpur District, West Bengal, India. On the basis of data collected from 150 students, this research has the power of deduction to state empirically that the utilize of AI-based educational applications is the main reason for children's cognitive growth as they are better able to practice critical thinking, logical reasoning, and they can learn on their own. This is confirmed by the regression model that found a positive association ($\beta = 0.149$, $p = .000$), thus approximately 14.9% of the differences in the cognitive development can be explained by the AI tools use. Besides this, the data made a better connection between the engagement with the AI-powered apps and the children's social skills and emotional intelligence with a pretty high beta coefficient ($\beta = 0.497$, $p = .000$), thus almost 49.7% of the social development change could be accounted for by the given exposure. The results highlight how the duo of AI could be one of the advanced learning technologies but also an avenue for socialization and emotional growth in kids. The study, however, also points out the need for the carefulness and morality of AI implementation and, thus, suggests that parents and teachers be involved in the process of supervision to avoid the risk of AI dominance, make sure that human interaction is meaningful and that the safety issues, such as emotional disengagement or decreased sympathy, are not escalated.

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