

The Impact Of Technology On Children's Development: Balancing Cognitive, Social, And Emotional Growth In Digital Environment

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Abstract

Advances in technology are shaping the cognitive, social and emotional development of children. This article considers the influence of interactive digital devices, personal learning devices and virtual entertainment on children's behaviour. Although educational applications promote motivated, personalized learning experiences and increased engagement, overuse of educational applications may inhibit creativity and self-actualized autonomy of thought. As well, virtual "friends" and the superficiality of game settings impact on communication and interpersonal behaviors, likely increasing empathy but limiting face-to-face contacts. The research analyzes the ethical implications – data privacy and the psychological impact of algorithmically curated content among them. Drawing on a mixed-method analysis, the study highlights the positive and negative trends of behaviour transformation, providing actionable suggestions for parents, teachers and policy makers. Guidelines emphasize the need to use and design technology in balance to promote healthy living and support children's holistic development.

Keywords: Kids' Behavior, Cognitive Development, Personalization Learning, Digital Media, Social Skills, Emotion Development, Digital Wellness, Ethical Design, Behavioral Change, Privacy Issues.

INTRODUCTION

Artificial Intelligence (AI) has ushered its way into almost every facet of our lives, now deeply impacting activities (previously) reserved for human intelligence, such as reasoning, decision-making, problem-solving, etc. Today AI is in everything, from apps that suggest TV shows to real-time customer support chatbots. But the word "AI" is often loosely thrown around to describe technologies that don't match the high-level capabilities people expect. It's critical to understand what AI is, the different types of AI and the impact it is having in the lives of children, as it will continue to influence society and individual actions.

"What Artificial Intelligence is"

AI is the science and engineering of making intelligent machines, which are typically described as computers that have been designed to do things that would otherwise require human intelligence. AI, including technologies like machine learning, deep learning, and natural language processing, allows machines to perform things that we thought only humans could do. While there are debates around

whether today's technology qualifies as "real" AI, or simply a very sophisticated form of machine learning, it is fundamentally re-engineering our day-to-day experiences.

AI has a tremendous influence on the behavior of children – a double edged sword of sorts that will shape the development of the next generation. AI tools built into learning platforms and games as well as interactive technology affect how children develop cognitively, socially and emotionally.

OPPORTUNITIES

AI transforms learning experiences by personalizing these through adaptive systems, so that learning becomes more engaging and attuned to the individual (Holmes & Porayska-Pomsta, 2022). For example, conversational AI tools build communication skills and allow children to develop problem-solving skills. These have also been considered to facilitate child development responding to key shortages in cognitive and affective learning (UNICEF, 2024).

RISKS

On the other hand, also harmful impacts on development of healthy human children from AI are also raised. Prolonged interaction with AIs in entertainment or social situations could also lead to a reduction in key human-to-human interactions that relate to emotion regulation and social understanding. More ominously, algorithmic biases can reinforce stereotypes and present uneven developmental opportunities, specifically in educational and social contexts (Stanford HAI, 2023).

IMPORTANCE OF BALANCE

In order to realize the opportunities and neutralize the challenges presented by this new frontier, we need to promote ethical AI use. Policymakers, educators and developers should collaborate to define guidelines that enable AI to have a positive impact on children's behaviour and development (UNICEF, 2024; Holmes & Porayska-Pomsta, (2022).

LITERATURE REVIEW

Lattie et al. (2019) and Liu et al. (2022) examined the use of such digital tools to tackle anxiety, depression and stress in children and young adults. In this regard, AI-powered chatbots can provide instant and accessible emotional support to assist in the monitoring of mental health and the cultivation of resilience. This technique is particularly useful for early intervention, and is an addition to existing mental health services.

Williams, R., Park, H. W., & Breazeal, C. (2019), and how they can play an interactive platform, popbots, uses social robots and hands-on activities to teach preschool aged children (4–6) about basic ai concepts. Kids also learned about rule-based systems, supervised machine learning and generative AI. The most children understood the concepts well (particularly knowledge-based systems), and their attitudes to robots changed as they learnt. Children who had higher scores perceived robots to be smarter and more human-like. The authors discuss the need of the hour for early education on AI to develop a balanced and informed understanding of technology in the minds of young learners.

DARWISH, A. S., et al. (2025) introduced the Building Green Minds model, an AI approach to personalise and improve sustainability education. It overcomes the constraints of classical methods by providing interactive and personalized teaching tools. The survey finds strong interest in AI-powered platforms, and in particular in capabilities like simulations and adaptive quizzes. The research underscores the pressing requirement for education for sustainability and demonstrates the role AI can play in promoting critical thought and environmental responsibility. Overall, it is a timely and novel way for learners to prepare for a greener future.

Tripon, C., Gonța, I., & Bulgac, A. (2023) investigated the impact of digitalization, educational interactions and sustainability on student well-being and assessment at the level of a STEM university. Surveying 871 students, it finds that supportive teacher–student interactions are good for well-being, while unfair assessments are bad for it. Hybrid learning increases engagement and flexibility. The

research recommends setting a welcoming, inspiring atmosphere and prioritising self-care. It is, on the whole, a helpful, well-planned contribution to research in education.

Yang, W. (2022): The significance of young children learning AI education: Why to learn, what to learn, and how to learn. It acknowledges AI as digital literacy, and promotes age-appropriate, culturally responsive AI learning that is hands-on. The author introduces the “AI for Kids” project as a case study, connecting the AI education to real issues such as environmental issues. The paper is a useful resource for ECE teachers and advocates for more inclusive AI literacy to reduce the digital divide.

Patil, A., & Singh, N. (2023) applied influence of Artificial Intelligence (AI): Towards Child development and Parenting – explained how AI could assist child-rearing and child development. It pinpoints the various ways AI helps: tailoring advice, early identification of developmental concerns, improving learning – through virtual tutors and speech recognition. AI-enabled behavior analysis for reading the emotions of children, attitudes, and mental health. The paper also calls out ethical issues such as data privacy, bias and the need for human oversight. Though AI has many advantages, the authors emphasize that it should supplement – not supplant – human interaction in child care and education.

Muttaqin, M. A., Putro, R. L., & Ramadhan, A. A. (2025) qualify research on the effect of AI based application to early childhood cognitive by BA Aisiyah Ponorogo. Using interviews and observations, it concludes that apps like Khan Academy Kids and Duolingo improve motivation, creativity and problem-solving ability. Teachers noted greater student involvement and individualized learning opportunities. Parents appreciated the ability to track progress and be able to support learning at home. But concerns include screen time, less socializing and exposure to online dangers. The survey shows the need for supervision and age-appropriate content. A blended approach, using both digital and real-world experiences is advisable. AI works when it’s integrated well. The study has important implications for educators and parents.

Daniel, I. I., Okpa, O. E., & Comfort, N. A. (2024) explored parents’ perspective on cognitive development of primary school children in Calabar, Nigeria. Ag I. I. Daniel et al. Drawing on survey data from 600 parents, it finds that many see AI in a positive light in regards to the potential to improve personalized learning and academic results. Parents also perceive AI as useful in preparing children for future STEM jobs. But fears range from overdependence on AI, lack of creativity, academic cheating and isolation. Com’nova developed the following parenting programs with the same format for male and female parents. The study cautions parents to thoughtfully vet AI tools and to steer children in their use. It urges ethical AI to be integrated into schools. Stakeholder input is advised to achieve optimal gains.

Another study by **Shanmugasundaram, M., & Tamilarasu, A. (2023)** analysed the impact of digital technologies, social networking sites, and artificial intelligence on cognitive aspects e.g. attention, memory, and decision making. It describes the benefits – including personalized learning and nearly instant access to information – but also the risks, including a widening achievement gap, attention deficits, how information is stored in memory and, yes it says, addiction. For kids, there are developmental risks, but for older adults, a cognitive tool could prove rewarding. At times, an overreliance on AI tools such as ChatGPT can discourage critical analysis. The paper emphasizes the value of purposeful, mindful digital use, media literacy and limits on screen time. Excessive digitalization and multitasking have been found to distract us from our focus. Attention is drawn to the influence of social media on perceptions and feelings. It promotes healthy tech habits and additional reading.

RESEARCH GAP:

1. Simple and effective techniques to teach young children to understand AI and to design it ethically are missing. “It’s unclear what early exposure to A.I. does to children’s thinking and emotional development over time.

2. Although AI can help manage children's online activity and mental health, researchers are still not sure of its long-term effects. There need to be studies to find out how well these tools work, and how they weigh the technology with the human support kids still require.

OBJECTIVES OF THE STUDY:

To study the impact of Artificial intelligence on Children Behavior.

HYPOTHESIS:

H₀: Artificial intelligence does not have any significant impact on Children's Behavior.

Table 1.1

Combined Factor analysis for factor 1,3 and 5

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.869
Bartlett's Test of Sphericity	Approx. Chi-Square	1243.504
	Df	105
	Sig.	.000

Source: Primary Data based on questionnaire

Bartlett's Test of Sphericity states the multicollinearity which means variables are correlated among themselves. The significant value $.000 < .05$ states that variables are correlated and dimension reduction is possible. The KMO is a measure of sampling adequacy that used to verify the proportion of variance between the variables that might be caused by prime factors. The Kaiser-Meyer-Olkin (KMO) of sampling adequacy is 0.869 which lies in between 0.5 to 1.0 and it meets the applicability of factor analysis.

Table 1.2

Communalities

	Initial	Extraction
1. AI tools have improved my child's problem-solving skills."	1.000	.708
2. My child's ability to learn new concepts has increased due to AI.	1.000	.755
3. AI has made learning more engaging for my child.	1.000	.683
4. I notice improvements in my child's attention span when using AI educational tools.	1.000	.787
5. My child has developed critical thinking skills through interactions with AI.	1.000	.680
6. My child shows more emotional expression after using AI tools.	1.000	.764
7. AI-based content helps my child cope with stress or anxiety.	1.000	.859
8. My child feels more confident when engaging with AI applications.	1.000	.723
9. AI tools have helped my child understand and manage their emotions better.	1.000	.816
10. I believe that AI positively influences my child's overall mood and happiness.	1.000	.748
11. My child performs better in school after using AI educational tools.	1.000	.759
12. AI has made it easier for my child to understand difficult subjects.	1.000	.795
13. My child enjoys learning more because of AI tools.	1.000	.703
14. My child takes more initiative in learning new topics due to AI resources.	1.000	.697
15. I believe AI positively affects my child's overall academic performance.	1.000	.629

Extraction Method: Principal Component Analysis.

Source: Primary Data based on questionnaire

Table 1.2 represents the estimated communalities which represent the proportion of variance in each variable that is examined. The initial value of the communality is considered as 1 in a principal

components analysis. All the variables have coefficient value more than 0.4 and it well depicts that all the variables have high coefficient and assumed strong variables.

Table:1.3

Component	Total Variance Explained								
	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	8.986	59.910	59.910	8.986	59.910	59.910	4.467	29.781	29.781
2	1.088	7.251	67.161	1.088	7.251	67.161	3.593	23.951	53.733
3	1.030	6.866	74.027	1.030	6.866	74.027	3.044	20.294	74.027
4	.764	5.091	79.118						
5	.559	3.726	82.843						
6	.459	3.061	85.905						
7	.387	2.583	88.488						
8	.335	2.235	90.723						
9	.302	2.013	92.736						
10	.253	1.686	94.422						
11	.248	1.654	96.076						
12	.212	1.410	97.486						
13	.172	1.149	98.636						
14	.140	.936	99.572						
15	.064	.428	100.000						
Extraction Method: Principal Component Analysis.									

Source: Primary Data based on questionnaire

Table 1.3 depicts the variance of the variables using Principal Component Analysis. We have 15 components as we have 15 variables. Eigen values are the variances of the principal components. The total column contains the Eigen values. The first three component has Eigen value of 8.986, 1.088 and 1.030 respectively. The sum of the total Eigen values is always be equal to the total number of variables and it is 15 in our case. We retain only those components which have Eigen value greater than 1. Component 1,2 and Component 3 has the Eigen value greater than 1. So, we would retain only three components. Extraction sum of squared loadings gives the variance of only those components which has Eigen value greater than 1, which in our case for component 1,2 component 3 only. The percentage of variance of 1st, 2nd and 3rd component is 59.910, 7.251 and 6.866 and the cumulative percentage till 3rd component is 74.027. It depicts that first three components collectively account for 74.027 % of total variance. Rotation sum of square loadings gives the Eigen values by rotating the components. Percentage of variance of 1st, 2nd and 3rd component is 29.781, 23.951 and 20.294. The cumulative percentage for 1st and 2nd component here is differ from the 1st and 2nd component of extraction sum of squared loadings but cumulative frequency for third component is same in both the cases. The cumulative percentage till 3rd component reveals that 74.027% of the variance is accounted by the first three components. These components collectively demonstrate the multi-faceted influence of AI tools on children, covering intellectual, behavioural, and emotional dimensions.

Table 1.4

Rotated Component Matrix^a

	Component		
	1	2	3

CAD 2. My child's ability to learn new concepts has increased due to AI.	.771	.387	.101
CAD 5. My child has developed critical thinking skills through interactions with AI.	.766	.192	.237
CAD 3. AI has made learning more engaging for my child.	.746	.312	.172
CAD 4. I notice improvements in my child's attention span when using AI educational tools.	.725	.364	.360
CAD8. My child feels more confident when engaging with AI applications.	.563	.510	.382
BAS14. My child takes more initiative in learning new topics due to AI resources.	.112	.812	.161
BAS12. AI has made it easier for my child to understand difficult subjects.	.391	.788	.143
BAS1. AI tools have improved my child's problem-solving skills."	.472	.639	.277
BAS11. My child performs better in school after using AI educational tools.	.459	.578	.463
BAS13. My child enjoys learning more because of AI tools.	.490	.547	.404
BAS15. I believe AI positively affects my child's overall academic performance.	.477	.535	.339
ESI 7. AI-based content helps my child cope with stress or anxiety.		.442	.811
ESI 9. AI tools have helped my child understand and manage their emotions better.	.467	.173	.753
ESI 10. I believe that AI positively influences my child's overall mood and happiness.	.495	.286	.649
ESI 6. My child shows more emotional expression after using AI tools.	.594		.641

Extraction Method: Principal Component Analysis.

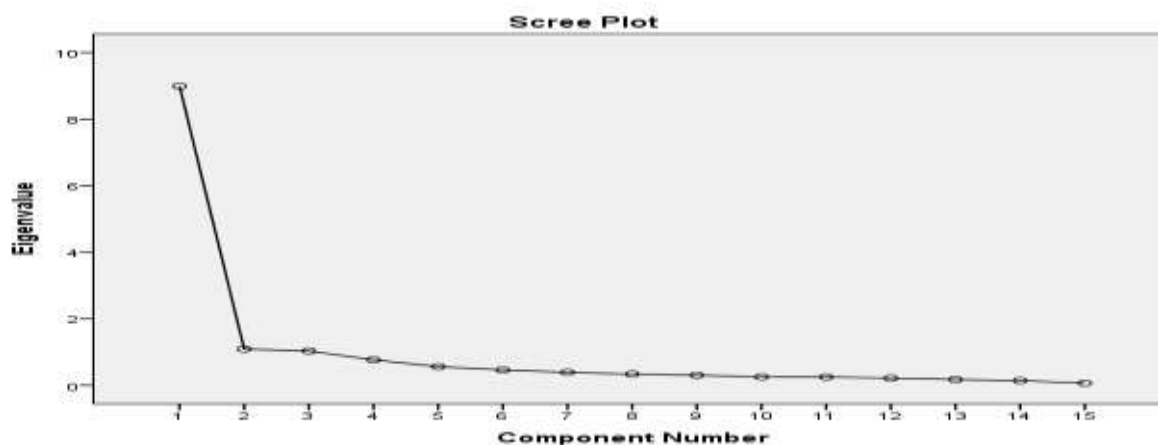
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 7 iterations.

Source: Primary Data based on questionnaire

Above table shows the factor analysis resulted in extraction of 3 factors. Factor 1 comprises loading from items of constructs Cognitive Academic development. All the items in the construct Perceived benefits in factor 1 are with high factor loading. Items of constructs Cognitive Academic development CAD2, CAD5, CAD3, CAD4, CAD8, has factor loading more than 0.40 were loaded in factor 1. Item BAS14, BAS12, BAS1, BAS11, BAS13, BAS15 loaded under Behavioural and Academic Support. Therefore, loading of item PB10 in construct Perceived ease of use is also accepted. Further, Items ESI 9, ESI 1, ESI 10 and ESI 6 loaded under Emotional and Social Impact.

Figure 1.1



The scree plot graph represents that the Eigen value of first three components in the graph is above 1 and from the 4th component onwards, we can see that the line is almost flat as the each successive component has lesser to least weight age to the total variance. The components having Eigen value less than 1 will be excluded as account for less variance and are of little use. Hence, only three components having Eigen value more than 1 are considered useful.

FINDINGS:

The result in tables shows that all variable have extraction value >0.4 , meaning that they strongly contribute for the analysis. Emotional expression (0.764), stress management (0.865) and mood influence (0.748) are among other variables, illustrating strong potential of AI tools on Children's behavioural aspect. These three elements cumulatively include 74.027% of total variance; indicating a significant contribution of AI tools to different aspects of Children's Behaviour. AI tools develop children's problem-solving, critically thinking and conceptual borrowing skills, which are represented by loading high weights on the first dimension. Behavioral changes such as enhanced initiative for learning, improvement in academic performance and interest in studies as a result of interactive AI based learning resources. Emotional and social effects are also significant, and AI has the ability to help children regulate emotions, cope with stress, and maintain a positive mood. The findings indicate that AI applications significantly enhance children's cognitive, behavioral and emotional development.

SUGGESTIONS:

To harness AI for the positive development of children, parents and educators should select tools that enhance capabilities for critical thinking, creativity, and emotional development, while also being suitable for the age at hand. Developers can design AI apps with customizable features for different learning styles, while schools can incorporate artificial intelligence into curriculums to boost engagement and performance. Parents should be monitoring use, instead of relying completely on technology. Further, educational programmes may shape the responsible use, whilst future research should investigate the long-term implications of AI to guarantee its ethical and sustainable use.

CONCLUSION:

It is noted from the analysis that AI has a very strong influence on children's behaviour over the constructs; Cognitive academic development, Behavioural and academic support, Emotional and social well-being. The high factor loadings and explained variance indicated that there were strong relationships between AI use and these factors. Therefore we reject the null hypothesis (H_0). This is because in children, AI influences behaviour. The results suggest that well-designed AI that supports problem-solving can lead to improvements in problem-solving ability, academic performance, and emotional resilience in children. But the balanced and guided use of them is key to reduce risks. Responsible & engaged AI can transform the way children learn and develop, providing a whole-child approach to education and development.

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