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AI and the Teenage Brain: Exploring the influence on Learning, Memory, and Decision-Making"

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Abstract: - Digital gadgets, social media sites, and artificial intelligence (AI) tools are now deeply ingrained in our everyday lives and are essential parts of our contemporary culture. Economists are paying more and more attention to how children and teenagers make decisions. Research reveals prospects for economics to comprehend the developmental reasons behind abnormal behaviour in adults and to suggest early treatments that can enhance mature results. However, studying children also presents unique difficulties that call for modifications to methodology. They each have different information-gathering strategies, personal goals, and constraints. We discuss new findings that point to a maturational gap between the early teenage brain remodelling of socioemotional reward method as well as gradual, protracted strengthening of cognitive-control method as the primary cause of the tendency of adolescents to take risks. According to research, the reward system may become more sensitive to reward value of risky behaviour during adolescence, when people spend a greater amount of time with their peers.

Keywords: Decision-making, adolescent risk-taking, social media platforms, artificial intelligence, brain's socioemotional

Introduction:

Adolescents' learning, play, and social interactions are being profoundly impacted by digital technology including PCs, tablets, smartphones, and game consoles. Globally, people are using these devices for longer and longer periods of time. Even without accounting for time spent on homework, teens in the US spend an average of more than seven hours a day on screens. Naturally, this has led to rising worries regarding the effects of youth screen usage on health and wellbeing. While opinions on the increased quantity of screen time are largely agreed upon, opinions on its implications are not.4 Screen use has been linked in some studies to anxiety, sadness, sleep disturbances, and subpar academic performance [1]. Further research documents alterations in the physiology and structure of the brain associated with digital media. It is often known that teenagers take more risks than kids or adults do. This is demonstrated by higher rates of drug, alcohol, and cigarette experimentation, unprotected sexual behavior, violent and nonviolent crime, and careless driving. Little progress was made in the early stages of the hunt for the distinctive cognitive immaturity that underlies adolescents' increased tendency for taking risks. The ability of adolescents and adults to perceive and process basic components of risk information was compared in a long series of carefully crafted laboratory experiments. The results showed that adolescents have the same knowledge, morals, and processing speed as adults to evaluate risky decisions [2].

In fact, worries regarding how using digital media affects the structure and function of the brain as well as one's physical and mental well-being, social interaction, education, and political views are growing. The World Health Organisation (WHO) released stringent recommendations about kids' screen time in 2019. Additionally, he unveiled Assembly Bill 272, a measure allowing schools to impose smartphone usage restrictions. These steps were adopted in response to published research that linked heavy use of digital media to decreased working memory, psychological issues ranging from anxiety and sadness to sleep disturbances, and impaired text comprehension when reading on screens. This latter example, which may come as a surprise, demonstrates that reading intricate tales or related facts in a physical book improves memory of the plot, specifics, and connections between data more than reading the same text on a screen [3]. Recall appears to be improved by

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factors like the position on a page in a book where we read something and the distinct smell of each book. Considering that the text in a printed book and on an LED screen are the identical, the surprising results seem to be caused by these connections of facts with spatial and other sensory cues. Furthermore, according to language expert Naomi Baron, who was referenced in a Makin article, reading patterns differ in digital environments, which encourages cursory text examination [4].

1. Factors contributing to attentional overload in the digital world

In the digital age, attentional overload is caused by a number of variables. The deliberate design of digital platforms and gadgets is one of the most important considerations. Many digital platforms and gadgets are made with the express purpose of being extremely engaging. Gamification, alerts, notifications, personalised content, and reminders are just a few of the features that help these devices and platforms draw in, hold, and keep users' attention. Although these design elements have the potential to increase engagement, they also run the risk of increasing attentional overload. For instance, social media sites' "infinite scroll" function and autoplaying videos, which cause content to load continually as users scroll down, encourage mindless browsing and may cause attentional overload. Similar goals are pursued by application designers when using vibrant colours, animations, and interactive features. The sheer amount of information available in the digital age is another element that leads to attentional overload. There is an infinite amount of information available on the internet, and social media sites provide a constant flow of new stuff. An overwhelming amount of information might make people feel compelled to be informed and connected, which can result in constant multitasking and partial attention. Digital tool alerts and notifications have been shown to degrade cognitive function and cause attention problems. The average person checks their phone at least 85 times a day, and they are rarely aware of how often they are doing it. Additionally, quick conversations on mobile devices and "checking behaviours" are become more and more ingrained [5].

An accurate indicator of a student's aptitude is not a model that forecasted how well the student would do on an exam measuring memorisation of the content. The approach offers some oblique insights on a person's memory capacity, but it says nothing about the student's aptitudes, such as creativity and problem-solving ability. It is still possible to think of decision automation in terms of an AI decision-making process notwithstanding the distinctions between human and AI decision-making processes. The word "process" actually emphasises the reality that humans build the machine's decision-making mechanism. Furthermore, this phrase allows for the distinction of the start and finish points of decision-making. Most importantly, misrepresentation is avoided by using a definition that emphasises the process over the system. The phrase "artificial intelligence system" may give the false impression that the system is capable of performing tasks that would need human intellect or that the choice made by computer scientists about the variable to be forecasted had no bearing on the candidates' results [6].

2. Decision-Making in Cognitive Situations

Because they are not immediately faced with the repercussions of their choices, individuals in cognitive circumstances do not experience emotionally meaningful gains or losses as a result of their selections. As a result, rather than focussing on the ability to regulate emotional reactions, these scenarios mainly test one's ability to think. Proportional reasoning models have been employed, for instance, in studies on cognitive decision-making that concentrate on logical reasoning skills. Choice possibilities in proportional reasoning differ along one or more choice dimensions, which need to be integrated to get the right answer. Findings in this area of study point to a rise in proportional reasoning abilities during development. Youngsters go through several less-than-ideal phases before applying the proper multiplication/proportional rule. Young children first use the one-dimensional choice rule, which only takes into account prevailing dimension in their response. In succeeding phase, kids initially concentrate on dominant dimension as well, but if dominating dimension of the two options they are given is equal, they also take subordinate dimension into account [7]. Eventually, the right course of action—multiplying the choice dimensions using the integration rule—will be taken. According to recent study, young infants (as young as age 5) may already be processing probability information and applying one- or two-dimensional choice rules. Additionally, it has been demonstrated that young teenagers (their age 13)

are capable of using appropriate proportional integration between two task dimensions (i.e., the number of winning and losing beads). These findings suggest that teenagers are capable of understanding probability, applying multidimensional techniques to decision-making, and performing reasonably well on tasks involving proportional thinking. It can be said that these reasoning abilities are crucial for making wise decisions. Furthermore, research has demonstrated that adolescents and adults are similar in how they perceive risk and weigh the potential repercussions [8]. Hence, adolescents' poorer performance on emotive tasks does not appear to be explained by immature cognitive-reasoning abilities. However, decisions made in affective decision-making tasks typically depend on many dimensions, while majority of research on reasoning capacities focusses on decisions made based on no more than two aspects. For instance, three choice-dimensions—frequency of loss, quantity of loss, and amount of continuous gain—define the alternatives in affective Iowa Gambling Task. Therefore, it is impossible to make firm conclusions regarding the reasoning abilities of adolescents in these more difficult activities. Thus, examining teenagers' cognitive decision-making ability in increasingly complex decision-making scenarios is another goal of this research [9].

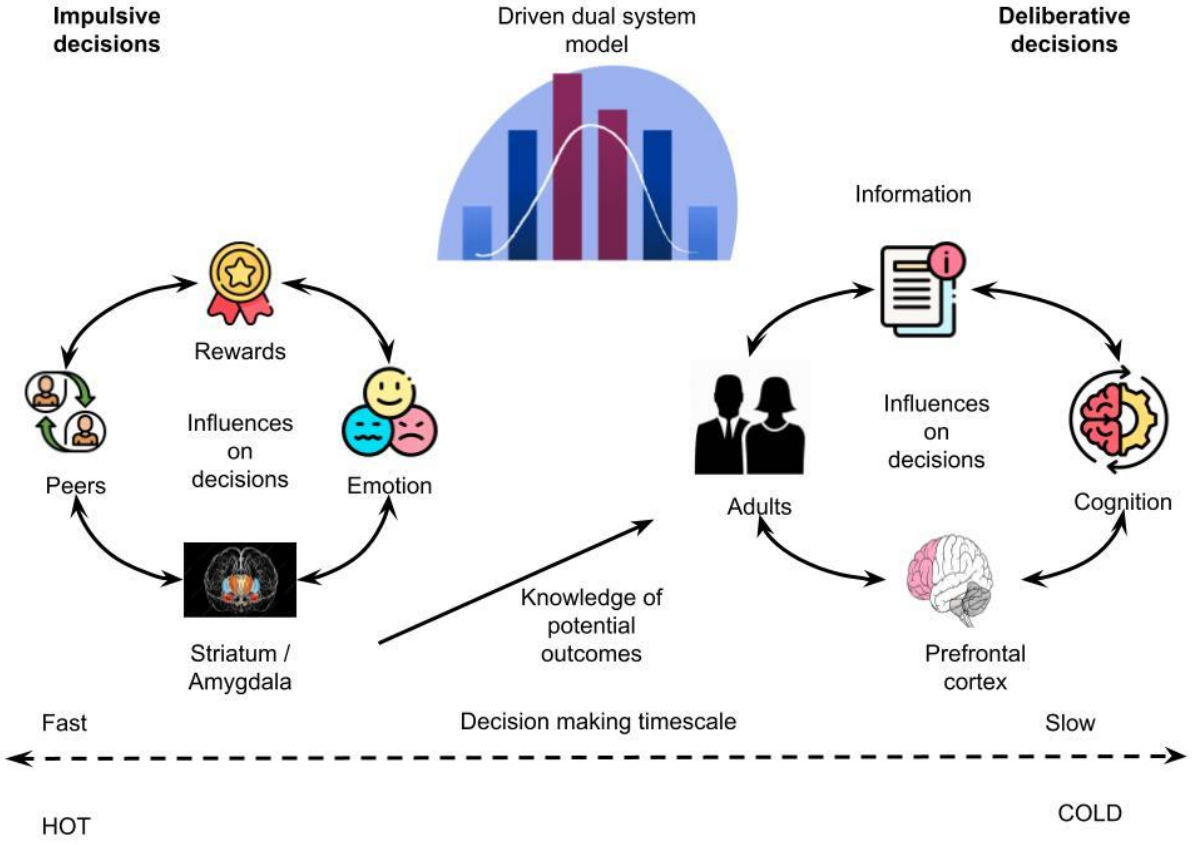


Figure 1. Timescales and Contextual Influences on Adolescent Decision-Making.

Striatum is engaged in "hot" decision contexts during adolescence, which are characterised by short timeframes, reactive processes, decisions based on reward, emotion, peer influences. These scenarios are depicted in the left panel (red). The adolescent "cold" decision situations depicted in the right panel (blue) are ones in which choices are made over extended periods of time, including deliberate procedures, relying on adult, informational, cognitive effects as well as activating the prefrontal cortex. Central panel represents "Driven Dual Systems Model" of development of adolescence. It shows that although prefrontal, cognitive (blue) systems are available during adolescence and are activated for decisions made in "cold" contexts, they are frequently motivated by affective methods in order to obtain rewards, mainly in "hot" contexts.

According to field's current understanding of teenage neurocognitive development, teenagers and young adults are capable of making goal-oriented decisions at the adult level, even ones with long-term repercussions, given the right circumstances, which include adult support, longer timescales, and the data needed to assess the results (Fig. 1). Therefore, developmental cognitive neuroscience research contradicts legislators' arguments prohibiting GAC access for TNB youngsters on grounds that executive brain method is not yet "fully developed," making decisions made by adolescents and young adults ill-informed and possibly non-consensual.

AI decision-making processes

The focus of the current analysis is on using AI decision-making procedures to represent the individuals, evaluate their performance with a margin of error, and determine whether or not each individual is entitled to a favourable outcome. Since the focus of the inquiry is on university admissions selection, numerous applications of the process—such as the use of AI algorithms for disease diagnosis and resource allocation for public service—are left out of the discussion. The examination focusses on the effects that the application of AI decision-making processes has on those who are most impacted by being in relationships that are unequal. The results can be applied beyond the case study of university admissions to the workplace and other situations where a comprehensive evaluation of the candidate and the use of discretion help achieve socially just results. Some of the ways that the use of AI decision-making processes may impact people's interactions with one another and with society institutions can be identified using the vulnerability theory lens [10].

Participants

It was crucial that the participants have leadership skills, hold leadership positions, and be involved in educational processes because the goal of this study was to comprehend the experiences of educational leaders using AI to influence decision-making, teaching, and learning outcomes. The participants' years of experience ranged from three years to thirty years, with the least experienced having three years. Eleven male and four female individuals were enrolled in the study. Through cooperation with the leadership of the chosen set of schools, the participants were gathered. Before signing the informed content form, study participants had to make sure they understood the rules of their participation. The analysis revealed seven themes and several subthemes. The themes were identified through a thorough and rigorous plan. The researcher first read and re-read the study data to familiarize myself with it; then, the researcher coded the data using NVivo and organized the themes accordingly. Table 1 below summarized the themes as well as their subthemes.

Table 1 Themes & Subthemes

Theme	Subthemes
Critical thinking	Enhance critical thinking Hinder critical thinking
Decision making	Data analysis Effective decision making through big data
Ethical concerns	Fear of privacy breaches Students use the AI to write essays
Grading and feedback	Instant feedback about performance Provision of improvement areas

Data Analysis

The study's participants conveyed a great appreciation for artificial intelligence's ability to analyse large datasets, acknowledging its potential to provide insightful information that is essential for making well-informed decisions. During the survey, for example, Eman went into detail on how artificial intelligence (AI) has transformed his methods for analysing data and making decisions, especially when it comes to assessing student performance. Through the use of AI, Eman was able to obtain real-time insights into a variety of student learning characteristics, which allowed her to see previously hidden trends and patterns. With the ability to evaluate student progress more quickly and accurately, teachers like Eman were able to act pro-actively and offer focused support right when and where it was most needed. For one set of facts, both student groups possessed greater domain knowledge, but for other set, their domain knowledge was lower. Students' responses to elaborative interrogation were greater in their high-knowledge domain than in their low-knowledge domain, as Figure 2 illustrates. Similar trends have been observed in other research that have altered the familiarity of to-be-learned information; new facts about known items show strong impacts, but facts about unfamiliar items show lesser or nonexistent effects. The literature's general conclusion is that high-knowledge learners will typically benefit from elaborative-interrogation method most, notwithstanding a few exceptions. Benefit for lower knowledge learners is less certain.

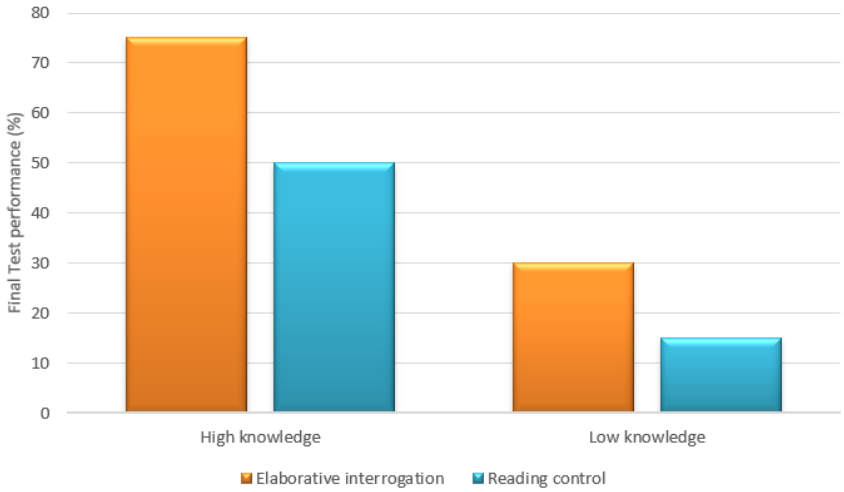
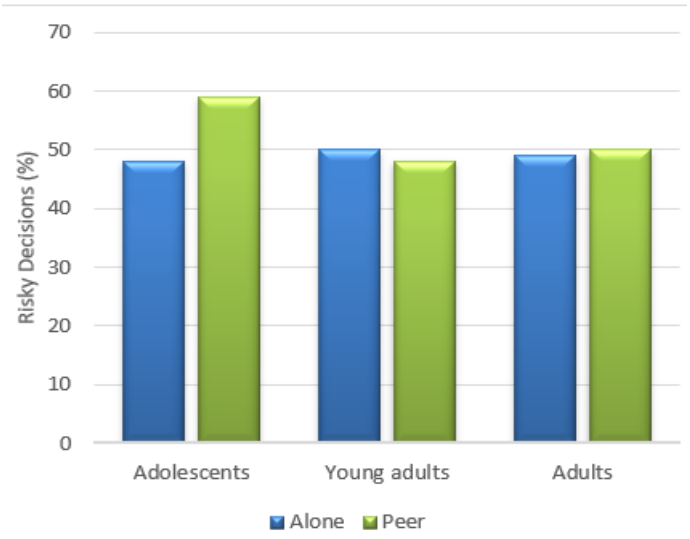


Figure 2. The average proportion of accurate answers on a final exam for students with high or poor domain knowledge who read exclusively during class or who participated in elaborative interrogation



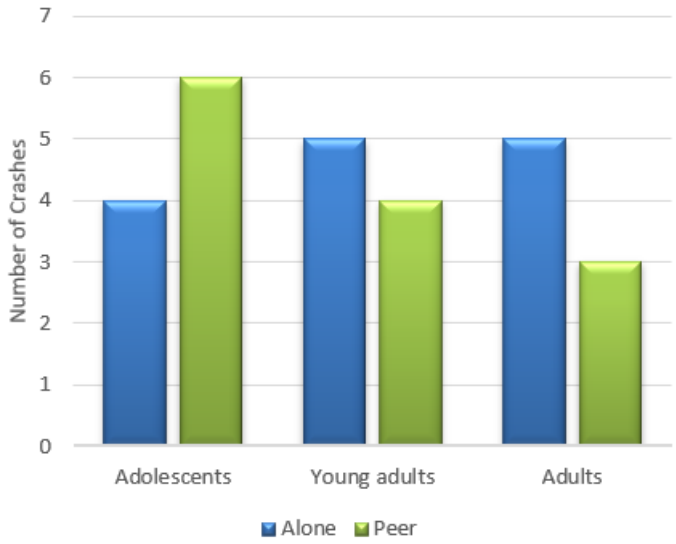


Figure 3. Chein, Albert, O'Brien, Uckert, and Steinberg (2011) found that peer effects had an impact on the Stoplight game performance of adolescents, young adults, and older adults.

The graphics show (a) the mean proportion of risky judgments and (b) the total number of crashes for players who are playing the Stoplight game with a peer audience or alone. Error bars display the standard errors of the mean.

Every participant in the scanning played the game twice: once in the paired condition, when they were informed that two peers of the same age and gender who had accompanied them to the experiment were watching them play on a monitor in an adjacent room. Adolescents, but not adults, took noticeably greater risks when they were seen by their friends than when they were by themselves, as expected (Fig. 3).

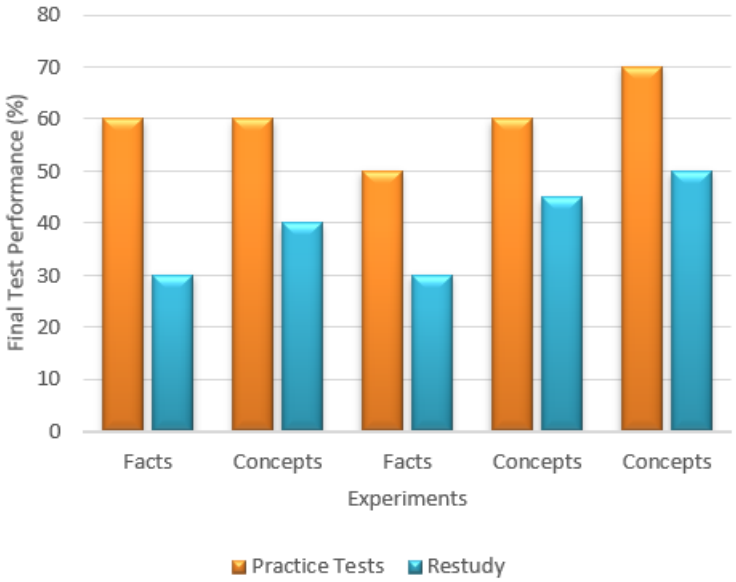


Figure 4. Accuracy on final exams in Butler (2010), which were given one week following a learning session that included practice exams or restudy and had inference-based transfer questions highlighting important facts or concepts. Standard errors are shown by error bars.

After practice testing, performance was better than after restudy on new inference-based short-answer questions that tapped into essential facts and concepts (see Fig. 4). Results of a follow-up experiment are especially

noteworthy because criterion test involved far transfer, meaning that students had to apply knowledge from one domain to a new one in order to answer questions (for example, they had to draw conclusions about the evolution of new aircraft types based on knowledge about bat wings).

3. Conclusion:

Purpose of this study was to examine and explain how educational leaders felt Artificial Intelligence (AI) affected their decision-making, instruction, and learning results. Even if their usage of digital technology may be lesser, older individuals are becoming more engaged with it. The utilisation of digital devices by senior citizens may provide several advantages, such as improved mental abilities, increased social interaction, and easier access to medical data. Cognitive training through digital platforms—computer programs, smartphone apps, wearables, or web-based platforms—offers exercises specific to target cognitive domains, such as memory, attention, and executive function, with the goal of enhancing general cognitive abilities and day-to-day functioning. These findings emphasise the importance of taking into account a variety of neural pathways that could underpin various forms of peer influence during adolescent development. Additionally, functional connectivity between subcortical and cortical regions may be able to mitigate maladaptive risk-taking, particularly in situations where adolescents are subjected to risky peer influence.

Reference:

[1] Rezaei, N., & Saghazadeh, A. (2023). Introduction to Brain, Decision-Making, and Mental Health. In *Brain, Decision Making and Mental Health* (pp. 1-17). Cham: Springer International Publishing.

[2] Daneshvar, H., Boursalie, O., Samavi, R., Doyle, T. E., Duncan, L., Pires, P., & Sassi, R. (2024). SOK: Application of machine learning models in child and youth mental health decision-making. *Artificial Intelligence for Medicine*, 113-132.

[3] Wang, G., Bao, H., Liu, Q., Zhou, T., Wu, S., Huang, T., ... & He, S. (2024). Brain-inspired artificial intelligence research: A review. *Science China Technological Sciences*, 1-15.

[4] Lamb, R., Firestone, J., Kavner, A., Almusharraf, N., Choi, I., Owens, T., & Rodrigues, H. (2024). Machine learning prediction of mental health strategy selection in school aged children using neurocognitive data. *Computers in Human Behavior*, *156*, 108197.

[5] Saeed, S., Hussain, M., Naqvi, M., & Jabbar, K. A. (2023, February). A Systematic Literature Review of How to Treat Cognitive Psychology with Artificial Intelligence. In *International Conference on Mathematical Modeling and Computational Science* (pp. 359-369). Singapore: Springer Nature Singapore.

[6] Firth, J., Torous, J., López-Gil, J. F., Linardon, J., Milton, A., Lambert, J., ... & Firth, J. A. (2024). From "online brains" to "online lives": understanding the individualized impacts of Internet use across psychological, cognitive and social dimensions. *World Psychiatry*, *23*(2), 176-190.

[7] Abbaasi, M., Mashhadi, A., Bigdeli, I., & Shahaeian, A. (2024). The prediction of emotional decision making from working memory and inhibitory control in preschool children: using decision tree model. *Child Neuropsychology*, 1-19.

[8] Sargazi Moghadam, T., Darejeh, A., Delaramifar, M., & Mashayekh, S. (2023). Toward an artificial intelligence-based decision framework for developing adaptive e-learning systems to impact learners' emotions. *Interactive Learning Environments*, 1-21.

[9] Lima, J. F., Acosta-Urigüen, M. I., & Orellana, M. (2024). Machine learning and knowledge engineering for cognitive memory assessment of age groups by anomalies in a serious game. *Intelligent Systems with Applications*, *21*, 200301.

[10] Zhang, H., Perry, A., & Lee, I. (2024). Developing and Validating the Artificial Intelligence Literacy Concept Inventory: an Instrument to Assess Artificial Intelligence Literacy among Middle School Students. *International Journal of Artificial Intelligence in Education*, 1-41.