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AI and Adolescents: The Interplay Between Technology Use, Academic Success, and Social-Emotional Growth

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Abstract: - Even though artificial intelligence (AI) is being utilized extensively in education today, little is known regarding potential negative effects, particularly on the cognitive and physical development of educated individuals. To prevent any unintended consequences, it is critical to investigate potential implications of using artificial intelligence to education (AIEd). In addition to determining the pertinent psychosocial variables that can predict teenagers' social adaptation, purpose of this study was to look into impact of AIEd on these traits. This study intends to look into how students' social ties in a classroom setting are affected by artificial intelligence. Understanding how student-teacher interactions have changed as well as the wider consequences for social dynamics both within and outside of the classroom are the main points of emphasis. The study's findings, which are based on random forest regression structural modelling, show that social media and artificial intelligence (AI) both benefit university students' academic achievement and mental health.

Keywords: Artificial intelligence, AIEd, social adaptability, structural modelling, random forest

1. Introduction:

Artificial intelligence (AI) technology is without a doubt one of the most significant inventions that affects many facets of human life in the present era characterised by technological advancement. The idea of AI is used to development of computers and computing systems that can carry out tasks that typically call for human intelligence. A subfield of computer science known as AI focusses on the building of intelligent computer systems, or systems that can think like humans [1]. Data processing problems that were previously difficult or even impossible for humans to successfully solve have been overcome by AI. AI has emerged as a promising tool for enhancing teaching and learning, and it has the power to completely transform a number of industries. Artificial intelligence has brought about a significant revolution in the education sector. Because technology is developing at an ever-increasing rate, educators must constantly adjust to new innovations in the field to avoid appearing outdated. This is especially true for students. The ever-accelerating pace of technological advancement has an effect on how students' personalities develop, particularly on how they interact with one another in the classroom. Some experts do, however, think that AIEd may carry some hazards. For instance, data leakage from the use of intelligent technologies to gather student data may result in safety and ethical issues [2]. Because of the bias of those who create and implement AIEd, some academics are even concerned that it may stray from its intended instructional goal and turn into a potentially dangerous behaviour. The majority of AIEd beneficiaries are adolescents, who are in a vulnerable stage where they are easily influenced by their surroundings [3]. Lack of research on emotion as well as influencing variables has always been a major issue in AIEd, as prior studies have primarily covered the theoretical effects of AIEd on adolescents. Thus, it is crucial to consider how AIEd affects teenagers' physical and mental development [4].

2. Artificial Intelligence and Social Adaptation

The manner that teachers and students communicate may alter as a result of AIEd. In the past, face-to-face interactions between instructors and students took place at a set location and time. There may be less opportunities for in-person communication as a result of AIEd. Furthermore, without the Internet and electronic gadgets, AIEd cannot be carried out. Frequent use of electronic devices negatively affects adolescents' social adaptability and interpersonal connections, according to a prior study [5]. Additionally, research [6] discovered a causal link between teenagers' social flexibility and their use of networks. It's unknown, though, if AIEd might also have a detrimental effect on teenagers' capacity for social adaptation. Conversely, some research has even

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indicated that AI can help adolescents' talents grow. For instance, a study by Ali, Park, and Breazeal [7] showed that kids who engage with social robots exhibit highly creative thinking. Furthermore, empirical studies have shown that teens with autism spectrum disorder may be better able to communicate themselves when they wear a wearable robot. The majority of AIEd receivers are adolescents, who are highly susceptible to the effects of their surroundings [8]. Nevertheless, there may have been some limitations because earlier research primarily examined the theoretical implications of AIEd on teenagers.

Application of artificial intelligence in education and social adaptability

A person's capacity for social adaptation depends on their interpersonal connections. In particular, positive interpersonal relationships support social adaptation; negatively, they do not [9]. An individual's capacity and expectation to develop social engagement is more likely to be weakened by media communication than by face-to-face communication because to absence of important nonverbal and environmental cues like vision, hearing, and touch. These theories are based on cue filtering orientation and are referred to as theory of social presence as well as theory of social cue reduction. Even though non-face-to-face online social contact lowers social pressure as well as social anxiety compared to real face-to-face social contact, the majority of young people with social anxiety withdraw even more from real social contact after receiving social support online, which is detrimental to their social adaptability [10].

3. Proposed random forest regression structural modelling (RFRSM):

- While AI will play a major role in what is described, other technologies—while less popular right now than AI—will also play a significant role. Three examples of these technologies include seamless multimedia services, cellphones, and high bandwidth connectivity. These capabilities will be further enhanced with the introduction of 5G communications networks in the coming years.
- Cloud services to put into practice the intricate features required for AI in education. When compared to AI, this technology is a bit of a Cinderella, but it is essential for implementing the majority of the required functionality.
- Experience API (xAPI) is another significant technological advancement. This offers a standardised interface that makes it possible for students to effortlessly access knowledge from a variety of sources and maintains an extensive learning record for every student.

Figure 1 below depicts a potential AI-based educational system in action. Both more fundamental adaptive learning and the complex deep learning AI approach are used for personalisation. The xAPI interface, which also includes a Learning Record Store where each student's learning record is kept, holds the system together. A system like this might be applied to industrial and professional education as well as education at schools and universities.

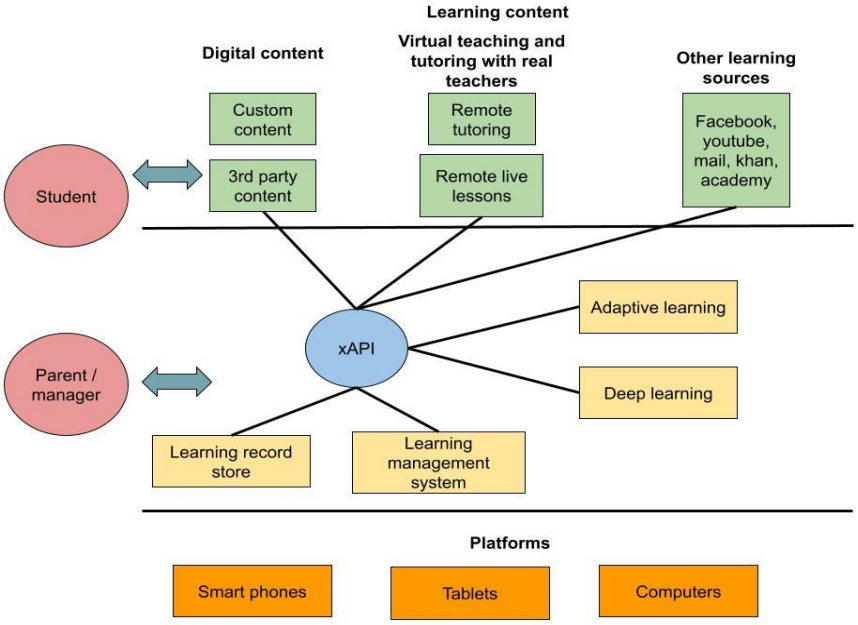


Figure-1 implementation of an AI based education system

Cloud services would be used to implement most of this system. These cloud services encompass both standard IT functions and advanced AI processing. The security of data stored on cloud servers, particularly student data, may be a problem in this case. Although top cloud providers typically have more security policies than anything run by education providers directly, this still needs to be carefully considered. AI technologies also provide a plethora of information and tools for various aspects of teenage skill development and personal improvement. AI algorithms are used by virtual mentors and coaching applications to offer individualised advice and motivation, assisting teenagers in creating goals, forming routines, and building resilience. Platforms such as Habitica, for instance, use AI-powered features to gamify personal development, making goal-setting as well as habit-building an enjoyable and fulfilling experience for teenagers. Furthermore, new study has shown that AI-driven technologies can boost traits like curiosity, grit, attentiveness, and persistence that are frequently linked to creativity in people of all ages. The extension of creativity across age groups can be supported by AI, even if creativity may appear differently at different life stages. According to a recent survey, teenagers consider that although AI cannot be creative in and of itself, it can be creative when used in conjunction with other AI tools, such as software for creating music. Even while AI can't replicate human creativity, its range of uses and programming abilities can encourage teenagers to discover their own creative potential and find new methods to express themselves.

Since this study is exploratory in nature, machine learning methods rather than conventional regression models are more suited for this type of investigation. Our choice to apply machine learning to provide a thorough analysis is influenced by three reasons. First off, because random forest (RF) is insensitive to missing data, using it to run a regression model can preserve the study's correctness. Furthermore, RF can highlight the significance of various possible predictors. Additionally, RF is more adept at handling the examination of numerous variables. Consequently, a preliminary analysis is conducted using partial dependence plot (PDP), ML approach, to evaluate difference in social adaptation between the AI group as well as non-AI group.

A library called partial dependence is used to visualise the input-output correlations of ML methods. It is capable of measuring the change in prediction that occurs when one or more input features are changed. On the other hand, PDP is plotted using a machine learning model. The RF technique was also used in this investigation. The RF method builds many decision trees and uses the sum of the different trees to determine the optimal classification outcome. It offers an ensemble learning approach for classification. The tendency of decision trees to overfit to their training set can be broken by random decision forests. The RF technique used with the Python Sklearn classification method is described below. This strong, second-generation regression analysis combines multiple linear regression with confirmatory factor analysis (CFA), allowing both structural and measurement models to be used at the same time.

4. Experimental analysis:

Structural Equation Model Analysis

Number of latent variables was reduced, taking into account model's complexity, prior to applying SEM to evaluate the proposed model and examine the connections between its components. More precisely, four indications of cybervictimization—impersonation, online exclusion, visual cybervictimization, written as well as verbal cybervictimization—were employed as latent variables. Lastly, three indications of emotional intelligence were incorporated in EI: emotional control, emotional clarity, and attentiveness to feelings. $\chi 2$ (18, n = 3451) = 53.67, $\chi 2/gl$ = 2.98, $p < 0.001$, IFI = 0.97, CFI = 0.97, TLI = 0.97, RMSEA = 0.048 were the appropriate adjustment rates. (SRMR = 0.0.41, IC 90% = 0.041–0.053). Using standardised regression weights, contribution of every factor to prediction of other variables was investigated.

The following describes the correlations between the various elements that made up the model: (a) EI ($\beta = -0.61$, $p < 0.001$) as well as academic achievement were adversely predicted by cybervictimization. Put differently, kids' academic performance suffers as a result of cybervictimization, which has a detrimental effect on their emotional intelligence (EI) levels.

(b) Academic achievement was favourably influenced by emotional intelligence. Moreover, cybervictimization was inversely predicted by EI ($\beta = -0.49$, $p < 0.001$). Stated differently, emotional intelligence (EI) improves high school pupils' academic performance and reduces their vulnerability to cybervictimization.

Application of AI in education (AIEd) was significantly negatively correlated with social adaptability. AIEd did not substantially correlate with the teacher-student or peer relationships, but it was significantly adversely connected with the parent-child connection as well as parent-child communication. In other words, AIEd is not significantly connected with school support, while it is considerably negatively correlated with family support. Support from family members may positively influence social adaptation, which is in line with other study findings. AIEd has a substantial negative correlation with both family support and social adaptation. (See Table 1).

Table 1 Correlation analysis results of AIEd, social support, social adaptability.

Variables	**M (SD)**	**1**	**2**	**3**	**4**	**5**
AIED	1.25	-	-	-	-	-
P-C relationship	63.15	-0.55	-	-	-	-
P-C communication	131.54	-0.85	0.735	-	--	-
T-S relationship	26.56	-0.44	0.311	0.289	-	-
Peer relationship	54.66	0.028	0.172	0.143	0.145	-
Social adaptability	5.44	-0.088	0.306	0.404	0.1656	-0.006

Note:* = $p < 0.05$

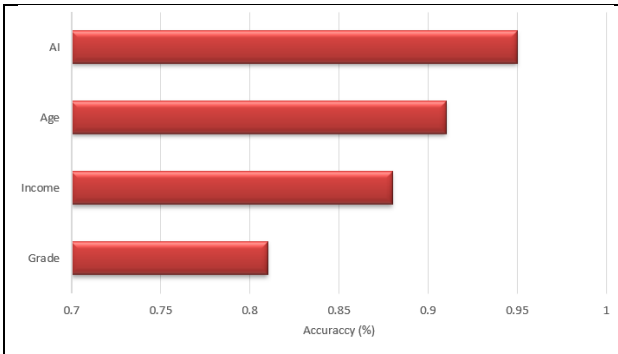
** = $p < 0.01$

*** = $p < 0.001$. P-C = Parent-child, T-S = Teacher-student.

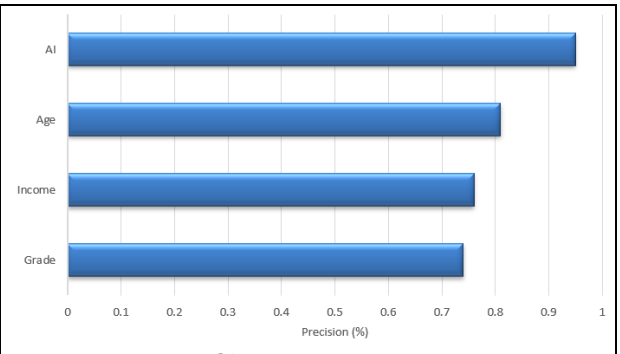
Table 2 displays the total number of effective subjects gathered for this study, which consisted of 1016 subjects in AI group and 312 subjects in non-AI group.

Table 2. Details of “whether to use AI for learning”

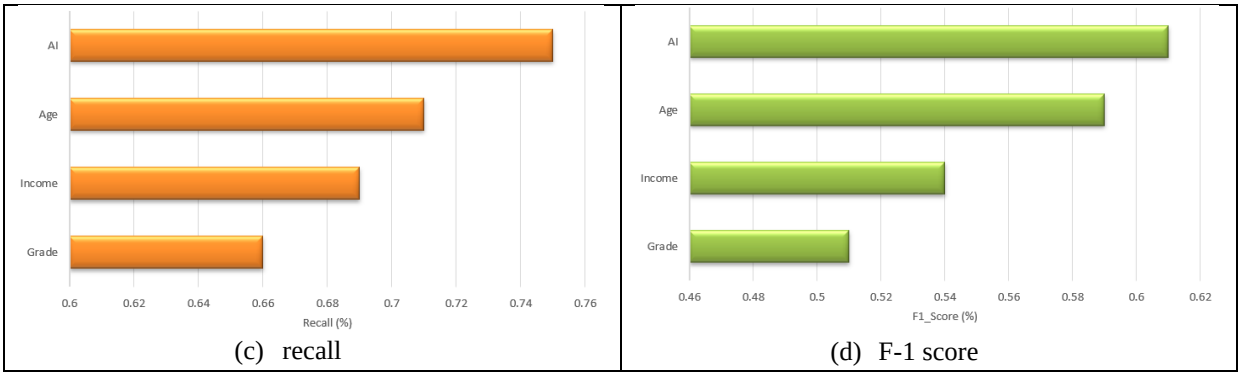
Group		**Number**		**Proportion**
AI group	1016	Male	516	36.85%
		Female	500	39.64%
Non AI group	312	Male	189	15.24%
		female	123	8.27%
Total		1328		100%



(a) Accuracy



(b) Precision



(c) recall (d) F-1 score

Figure-2 proposed model based ranking of variables on social adaptability predicted by RFRSM

Age, AIEd, grade, and family wealth all have an impact on how socially adaptive teenagers are, as Figure 2 makes clear. As a result, in our investigation, we control these variables. Next, we looked more closely at how AIEd affected teenagers' capacity for social adaptation. The expected social adaptation score for AI group is 0.266, but non-AI group's score is 0.152, based on the results. As shown in Table 2, the social adaptability score of AI group is significantly higher than that of the non-AI group. This suggests that, rather than having a detrimental effect on development of adolescents' social adaptability, AIEd may, in fact, somewhat promote it. This unexpected result also shows that AIEd's impact on teenagers' social adaptation differs significantly from that of other information technology products. We also looked at the connection between students' social adaptability and "the reason for them to use AI." Based on the findings, we discovered that the largest percentage of students (43.00%) use AI for learning because of assignments, followed by students (28.60%) who pick AI for learning because of their interests. Furthermore, 14.10% of students select AI as their learning platform because of their academic interests as well as assignments. Students who use AI for different purposes have significantly different social adaptabilities ($F = 2.910$, $p < 0.01$). Out of all of them, students who use AI to satisfy their parents' demands and pursue their own interests have the highest social adaptability score, while students who use AI to complete school assignments and satisfy parental requirements have the lowest score ($M = 10.69 \pm 14.74$). Notably, students who use AI to learn to fulfill their parents' requests had the lowest social adaptation ratings ($M = 3.25 \pm 14.59$).

5. Conclusion:

Purpose of this study was to find, from standpoint of social support, how use of AIEd affected adolescents' social adaptation. Findings indicate that teenagers' social adaptability is adversely impacted by AIEd. The adolescents' ability to adapt socially was significantly impacted by the unfavourable social interaction. In particular, strained peer and interpersonal connections can lead to a lack of social attachment, which can impede kids in AI groups from developing their social adaptation. Furthermore, academic emotions and loneliness are significant predictors of teenagers' social adaptation. These results highlight the important influence that learner-related, interpersonal, and social environment elements have on adolescents' capacity for social adaptation. But because of its cross-sectional nature, this study was unable to draw conclusions about causality. Longitudinal studies may be used in future research to examine the relationship between adolescents' social adaptability and AIEd.

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