

Educational AI Tool Use, Attention Span, and Critical Thinking among Secondary School Students : A Correlational Study

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Abstract

There is a growing trend in using AI in the education sector and while AI tools are increasingly part of students' learning lives, the relationship between the use of AI tools and students' cognitive learning outcomes in the secondary school level is not well documented in Pakistan. The present study aimed at finding out the relationship between the use of educational Artificial Intelligence tools and concentration spans and critical thinking of students in the private secondary schools of Lahore. A descriptive, cross sectional survey design was used. The data had been gathered from 400 students using a structured 30 item questionnaire comprising of questions related to attention span, educational AI tools, critical thinking, and the demographic questions. Descriptive statistics and Pearson correlations were used to analyze the data. The distribution of AI educational tools across students was high: 340 students (85.0%) used AI educational tools. Mean scores were 3.88 (SD = 0.66) for educational AI tool use, 3.62 (SD = 0.71) for attention span, and 3.54 (SD = 0.73) for critical thinking. There was a moderate positive correlation between the use of AI tools in education and attention span ($r = .521$, $p < .01$) while there was a higher positive correlation between the use of AI tools in education and critical thinking ($r = .614$, $p < .01$). Also, there was a positive relationship between attention span and critical thinking ($r = .486$, $p < .01$). The results in this study suggest that students' self-reported attention and critical thinking behaviors are linked to their self-reported frequency of use of educational AI tools. The study is a cross-sectional study with convenience sampling and self-report measures, so precautions must be taken in order to avoid making causal inferences from the results of the study. The results confirm that a moderately balanced method of teaching and learning is in use, combining the use of an AI system and copying/pasting AI-generated text with independent thinking and actively replicating the task.

Keywords: Artificial Intelligence student learning, AI in education, attention span, self-reported attention, critical thinking.

1. Introduction

The use of AI in education is now becoming a regular occurrence. We use AI-powered systems to get explanations, generate ideas, summarise notes, enhance writing, solve problems and to prepare for exams. In an educational context, these tools can be applied to provide real-time feedback, one-on-one support, and to save time in accessing and organizing information (Holmes et al., 2019; Johnson & Xu, 2023). In education, the adoption of AI inevitably brings a host of questions to the fore, not the least of which is: How is the use of AI in education related to the cognitive processes students need to learn effectively?

There are two such processes: attention and critical thinking. Attention span refers to the capacity to focus on the academic task and ignore distractive influences, and critical thinking refers to the capacity to process information, to evaluate claims, to compare alternatives, to detect errors, and to make decisions. These are two essential capacities that are key to learning with meaning. The promise of AI is to help students by reducing the superfluous cognitive load, providing explanations at the right time, or encouraging them to consider an alternate solution in a lateral way. However, failure to maintain attention, provide quality distractions, or receive machine-generated feedback without consideration for the content of the feedback may also compromise sustained attention and independent thought (Burbules & Callister, 2018; Elhai et al., 2023; Lee, 2024).

This has resulted in a kaleidoscope of literature. While research has shown positive results for personalization, engagement, problem solving, and higher-order thinking with the use of AI in learning, other studies caution about the potential for cognitive outsourcing and surface learning. The current application of AI in higher education (HE) was discussed by Zawacki-Richter et al. (2019) and opportunities and implementation

challenges in education were summarized by Chiu et al. (2023). Furthermore, as indicated in the studies mentioned in the thesis, there is evidence that AI can assist students in the field of analytical reasoning and critical thinking when they interact with its output and ask questions about the results (Fasahat et al., 2024; Khan, 2024; Zhang et al., 2025).

The Pakistani context becomes even more important, as the use of AI in education is happening at an incredible pace, without formal regulations on guidelines for AI literacy, classroom rules, or responsible use. There is the possibility that students can access ChatGPT, Grammarly, Google AI, and other similar tools without being systematically trained to scrutinize, to not overuse, to not be biased, or to manage their attention. Some emerging evidence in Pakistan has emerged related to the association between these factors: AI usage and academic performance, academic motivation, and critical thinking; but the research has not been done specifically to secondary-school students or on the simultaneous association of AI usage, attention span, and critical thinking (Hassan et al., 2024; Rehman et al., 2025).

This study fills this gap by combining the effort of private secondary schools of Lahore. This research doesn't take a stance on the positive or negative effects of using AI, but rather looks into the experience of students using AI in education, including how often they use it and their perception of its usefulness, as well as its impact on their attention and critical thinking. This framing is crucial as available cross-sectional survey data can provide statistical relationships, but may not provide evidence of causality between cognition and AI.

1.1 Study Objectives

To know the level of the application of AI tools in education in private secondary schools, Lahore.

To assess students' self-reported attention span, and critical thinking skills.

The relationship between using tools of educational AI and attention span will be examined.

To identify the relationship between the use of AI tools in education and critical thinking.

To find out the relationship between attention span with critical thinking.

2. Literature Review

2.1 Artificial Intelligence in Education

AI applications in the field of education include systems that can provide automated feedback and explanations, tailored support, intelligent tutoring, aid in the assessment process, and learning analytics. These functions may facilitate the learning process to be more responsive. AI is an emerging field in education technology, and can provide recommendations, predictions and decisions, that can be tailored to different learning contexts, as Chen et al. (2022) have suggested. In addition, AI can support the accessibility and inclusion goals by offering alternative representation and customized support (Xu et al., 2019).

One of the key benefits of educational AI is its ability to be instant. One of the most prominent advantages of educational AI is its ability to provide timely feedback and interventions. Students can get feedback as they work on a task, change their answer, and ask clarifying questions before the next class meeting. This can help to encourage more independent learning and reduce frustration. AI can also streamline complicated data, provide examples and compare and contrast representations of the same concept. But, when productive struggle is eliminated from learning, immediate help can be counterproductive. If learners persist in taking decisions and solving problems by using AI, but not in thinking, then they can only do it, but not be familiar with the meaning of the thinking process (Johnson & Xu, 2023; Lee, 2024).

2.2 AI Use and Critical Thinking

In critical thinking, learners should ask questions about the information rather than take the information at face value. The ability of AI to support this process through the provision of options for students to compare explanations, ask for alternative arguments, test their assumptions, look for solutions, or provide feedback on their reasoning. Zawacki-Richter et al. (2019) reported increase in using AI for higher order learning outcomes, whereas the studies mentioned in the thesis by Khan (2024) and Fasahat et al. (2024) associated learning with AI with reflection, evaluation and analytical thinking.

However the same technology can breed a sense of inaction. Automated problem solving may result in shallow cognitive learning, as found by Clarke (2020) and Burbules and Callister (2018). It is not just about what AI is, it's about how it's being used. Students can use AI to assist their thinking and learning processes, including verification of information, checking answers, and providing explanations of responses. The grammatically correct student who copies an answer without being evaluated may be delegating to the student what the

purpose of the critical-thinking instruction is. Similarly, Zhang et al. (2025) consider the dual nature of AI: a facilitator and a hindrance in the learning task and learner interaction with the task.

AI Utilization and focus span:

Attention is a limited, scarce cognitive resource and subject to disturbance. Educational AI can help when it helps to clarify something, explain at the right time, or break down a task into smaller steps. However, the use of AI is generally part of a broader digital environment, with users getting notifications as well as swiping to the next tab, prompting to edit, check, repeat actions. The idea is that changing, in terms of digital-multitasking and cognitive-load, can lead to attention splitters (Sweller, 2011; Uncapher & Wagner, 2018).

Elhai et al. (2023) is referenced for digital dependence and cognitive fragmentation while Rao and Banerjee (2024) is referenced for multitasking and cognitive fatigue. The concerns suggest that AI based learning could be associated with more or less attention, depending on the ways in which it is incorporated into learning plans. It may be more feasible than engaging in a prolonged interaction with multiple digital stimuli, which would leave limited space for a guided use model (AI use for specific academic tasks and then sustained use in isolation).

2.4 Student Engagement and the role of teachers

The use of technology and cognitive outcomes are connected by student engagement. Engagement is fostered when young people are active, get helpful feedback, interact with others and teachers, and put knowledge into action instead of just viewing it (Kuh, 2009; Bolliger & Martin, 2018). AI can help with these processes in several ways, such as creating personalized practice, providing real-time feedback, running simulations, virtual learning, and adaptive activities. The findings from studies cited by Chiu et al (2023) suggest that AI-supported learning environments could increase the motivation and engagement of learners in different learning contexts. Teachers continue to need to be involved. The learning value of AI is related to task design, expectations of verification, opportunities for reflection, and the ratio of automated support to autonomous activities. Teachers may ask students to explain why an AI-generated answer is right, to find evidence, to provide evidence to show that the AI-generated answer is incorrect, or to compare AI-generated answer with textbook/classroom sources. This kind of practice helps to maintain the human component in a decision-making process and makes AI simply an aid to thinking, not a replacement.

2.5 Conceptual Expectation

The study anticipated that there will be a positive correlation between using the educational AI tool and attention span, as well as critical thinking, especially if the AI is used to provide meaningful academic support. It also assumed that an increase of attention span would come with an increase on critical thinking because careful analysis, comparison and evaluation, usually, demands an extended attention span. These expectations are assessed as associations, based on the cross-sectional survey design of this study.

3. Methodology

Appropriate research design should be used and setting should be appropriate.

This study used a descriptive cross-sectional survey design to examine the relationships between the use of educational AI tools, attention span, and critical thinking. Private secondary schools of Lahore, Pakistan were used as the sample. A survey design was appropriate for describing the students' self reported behaviors, and for testing associations among constructs measured at the same time.

3.2 Participants and Sampling

Private schools of Lahore were chosen through convenience sampling of 400 secondary school students. The sample included 200 males (50.0%) and 200 females (50.0%). Participants were between 13 and 18 years old: 110 students (27.5%) were aged 13–14, 210 (52.5%) were aged 15–16, and 80 (20.0%) were aged 17–18. Grade 9 students accounted for 190 participants (47.5%) and Grade 10 students for 210 (52.5%).

3.3 Instrument

The data was collected using a structured questionnaire which contained 30 Likert type statements scaled as 1 (Never) to 5 (Almost Always) and was accompanied by demographic questions. The attention span scale consisted of 10 items, the educational AI tools scale of 10 items, and critical thinking behaviors scale of 10 items. The attention part included statements relating to maintaining attention, recovering from interruptions to attention, ignoring notifications, completing a task, and attention during challenging lessons. The homework support, ease of learning, use for difficult questions, use in class, summarisation, exam preparation, perceived

support for focus, and understanding of difficult topics were topics covered in the AI-use section. Problem analysis, verifying the accuracy of AI-generated information, comparing solutions, reasoning, evaluating trustworthiness, finding evidence, independent thinking, and identifying errors in AI information responses were among the critical thinking skills included in the critical-thinking section. In the thesis the attention measure is described as an adapted attention-span scale but no reliability coefficients and a complete validation procedure are presented and this is therefore seen as a methodological limitation in the present paper.

Data gathering and analysis were carried out. Data were collected and analyzed.

The researcher went to the secondary schools in Lahore and got 400 filled questionnaires. The frequencies, percentages, means and standard deviations were used to sum up the descriptive statistics. Pearson product-moment correlations were used to examine the relationships between using educational AI tools, attention span, and critical thinking. For comparisons between the two groups, the value of $p < .01$ (two-tailed) was regarded as statistically significant. Because of the use of convenience sampling and cross sectional self-report data, the results of the study should be interpreted as correlational and not casual.

The following tables provide descriptive statistics for the key variables. The descriptive statistics of the main variables are given below.

4. Results

Table 1. Participant Characteristics ($N = 400$)

Variable	Items	<i>M</i>	<i>SD</i>
Educational AI Tool Use	10	3.88	0.66
Attention Span	10	3.62	0.71
Critical Thinking	10	3.54	0.73

Educational AI tool use had the highest overall mean ($M = 3.88$, $SD = 0.66$), followed by attention span ($M = 3.62$, $SD = 0.71$) and critical thinking ($M = 3.54$, $SD = 0.73$). Overall, the self-reports were fairly positive on all three means, with values above the scale midpoints on each of the constructs measured. Participant characteristics: AI application and usage. Characteristics of participants and AI application and usage.

Table 2. Descriptive Statistics for the Study Variables

Characteristic	Category	<i>n</i>	%
Gender	Male	200	50.0
Gender	Female	200	50.0
Age	13–14	110	27.5
Age	15–16	210	52.5
Age	17–18	80	20.0
Class	Grade 9	190	47.5
Class	Grade 10	210	52.5
Educational AI tool use	Yes	340	85.0
Educational AI tool use	No	60	15.0

There was an equal distribution of gender and the sample was focused in the age group 15-16 years. Many respondents used educational AI tools: 340 of the 400 respondents (85.0%) used educational AI tools, 60 respondents (15.0%) didn't use any educational AI tools at all. This high rate reflects that the majority of the participants were already familiar with learning with AI.

Table 3. Selected Item-Level Descriptive Results

Construct	Statement	<i>M</i>	<i>SD</i>
AI use	Educational AI tools help me understand difficult topics more easily.	4.05	0.64
AI use	AI tools improve my understanding of difficult topics.	4.02	0.62
AI use	AI tools make learning easier for me.	4.01	0.65
AI use	I use AI tools during study time in class.	3.63	0.84
Attention	I complete my class tasks on time.	3.76	0.70

Attention	I quickly recover my attention after interruptions.	3.76	0.69
Attention	I can follow teacher instructions without losing focus.	3.72	0.71
Critical thinking	I compare different solutions before making decisions.	3.67	0.72
Critical thinking	I think independently even when using AI tools.	3.66	0.71
Critical thinking	I can identify mistakes in AI-generated responses.	3.66	0.77
Critical thinking	I rely completely on AI answers without checking.	2.79	0.98

The results were also presented at the item level, providing insights into students' utilization and perception of AI. The highest mean rating for the use of AI was for the statement about the use of AI in education enabling students to better understand difficult topics ($M = 4.05$, $SD = 0.64$). The same score was achieved with regards to an improved understanding of difficult topics ($M = 4.02$, $SD = 0.62$) and making learning easier ($M = 4.01$, $SD = 0.65$). The usage of AI was relatively low in the classroom ($M = 3.63$, $SD = 0.84$), indicating that students might be using AI for other purposes outside their classroom environment.

The highest scores for attention span were for completing class work on time and being able to quickly regain attention following interruptions (both $M = 3.76$). Relatively highly also was the scale of following teachers' instructions without losing focus ($M = 3.72$, $SD = 0.71$). Comparing solutions before decision-making had the highest mean ($M = 3.67$, $SD = 0.72$) for critical thinking, with independent thinking and finding errors in AI-generated responses also having means of 3.66. The lowest mean ($M = 2.79$, $SD = 0.98$) was found for the statement "I don't check anything that I get from AI answers" (negatively worded), which is directionally opposite to less uncritical use of AI.

Table 4. *Pearson Correlations among the Study Variables (N = 400)*

Variable	(AS)	(EAITU)	(CT)
1. Attention Span	1	.521**	.486**
2. Educational AI Tool Use	.521**	1	.614**
3. Critical Thinking	.486**	.614**	1

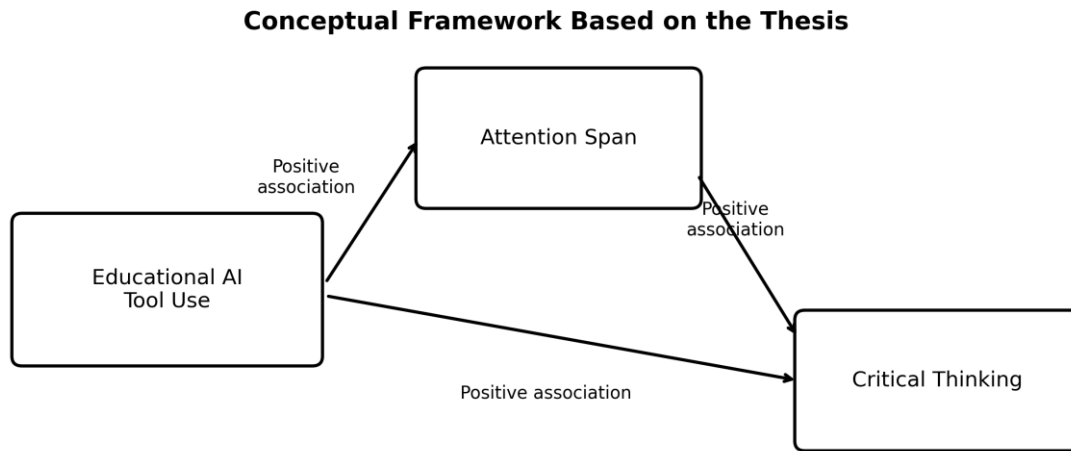
Note. ** $p < .01$, two-tailed.

There is a positive correlation between the use of artificial intelligence and the attention span, as well as between the use of artificial intelligence and critical thinking.

Positive correlations were found for all three variables (Pearson correlations), with statistically significant correlation for all variables. The use of the AI educational tools was moderately correlated with attention span ($r = .521$, $p < .01$) and strongly correlated with critical thinking ($r = .614$, $p < .01$). Another moderately significant correlation was found between attention span and critical thinking ($r = .486$, $p < .01$).

The most significant correlation was found between the use of educational AI tools and critical thinking. Students who indicated more frequent or more positive use of AI in education were also more likely to report behaviors like comparing options, evaluating information, looking for evidence, thinking independently and noticing errors. There was also a significant positive correlation between AI usage and attention, but this correlation does not indicate that using AI boosts students' attention or that more attentive students are more likely to use AI purposefully, or that there are other factors influencing students' attention and AI usage, including motivation, teacher support, and academic ability.

The following figure visually summarize the study framework and the main descriptive and correlational findings reported in the thesis



1. Figure

5. Discussion

The study showed that the use of educational AI is widespread amongst secondary school students of private schools in Lahore and that there are positive correlations between the use of educational AI, students' attention span and their critical thinking ability. The mean AI-use score was the highest of the three main constructs and 85% of participants were using educational AI tools. This means that AI is not a 'sometimes' or 'experimental' educational resource for students in the sampled schools, but it is a part of their education. The strongest relationship was with critical thinking ($r = .614$) with the use of AI in education. This association is in line with the literature that suggests that students' interaction with the AI output can positively impact the process of reflection, comparison, problem solving and analysis (Fasahat et al., 2024; Khan, 2024; Zhang et al., 2025). This is corroborated by the item-level results, where students' self-ratings of the three subscale scores (Comparing solutions, Thinking independently while using AI, Identifying errors in AI answers) were relatively high. In the meantime, those measures are self-reported perceptions. They don't perform on a true objective critical-thinking test. Another significant correlation is between attention span and AI usage ($r = .521$), and digital education has been discussed extensively with regards to distraction. The correlation between using AI and reduced concentration isn't easily applied to this current research. The students who reported the use of educational AI reported higher attention behaviors. One is that AI helps the students stay engaged by giving explanations on complex concepts, removing confusion, summarizing content, giving real-time assistance. The items with the highest levels of AI use were actually those that involved the making of topics easier to understand. It can be easier to keep a student engaged if he or she doesn't seem to be confused and can provide immediate responses. But the outcome shouldn't be interpreted as a reason to shrug off concerns about digital distraction or overuse. Questions were asked on the questionnaire regarding the digital devices causing lack of concentration, mental fatigue and according to the literature consulted in this thesis, cognitive fragmentation and multitasking are risks (Elhai et al., 2023; Uncapher & Wagner, 2018). The clearer reading is that, when used strategically, education AI may be used in conjunction with higher levels of reported attention, and when misused and/or overused can be harmful to attention. Because no measures were taken directly of frequency of task switching, screen time, compulsive use, or notifications, the study cannot differentiate between these patterns of use. The attention span was correlated with the critical thinking and found to be positive ($r = .486$).

This relationship is theoretically sound because complex reasoning will take time on task, cognitive persistence, and will have a resistance to distraction. A student with a strong ability to concentrate can compare and contrast choices, find evidence, evaluate the credibility of the evidence and notice inconsistencies. The relationship also shows that there is no need to separate attention and critical thinking as two different learning objectives in the school. Both can be assisted by the learning activities that promote extended thinking activities. The results align generally with the thesis discussion which cited Johnson and Xu (2023), Chiu et al. (2023), Fasahat et al. (2024), and Khan (2024) who all agreed that AI can aid in personalized learning, engagement, and analytical thinking. The result also confirms the hypothesis that there is an overreliance on AI (Lee, 2024). Students who participated did not use AI solely to answer their questions -- their mean (in the bottom one) was not the lowest of the sample for this. In reality, however, the study is unable to answer whether students are checking AI-generated content or not and requires training on the use of responsible AI. The pedagogical impact of AI is likely to be influenced by the pedagogical implementation as one of the key takeaways here is that the pedagogical impact of AI will be shaped by the pedagogical implementation. It is possible to plan the use of AI in the following steps, which can be organized by the teacher: Questioning, Evidence, Explanation, and Reflection. Students might, for example, be asked to compare an AI-generated response to a text to another answer, see which one does not have supporting evidence, or restate an answer, and brainstorm a few solutions with the help of AI, before selecting the strongest one. These are activities that help maintain intellectual responsibility. In contrast, assignments which can only be awarded based on the answer, can inadvertently promote cognitive outsourcing.

5.1 Practical Implications

AI should be used to better assist students to verify, explain, compare, and justify rather than to regurgitate answers generated by AI. Schools should offer foundational AI-literacy information on accuracy, bias, hallucination, checking the source, academic integrity, privacy, and appropriate uses and limits of use. Classroom routines need to protect sustained attention, including reducing changing devices in classroom routines and notifications during sustained attention. Teachers and parents must be able to tell the difference between good use of digital technology and effective learning and their purpose. Assessment design should still include some of the components of oral explanations, process evidence, reflection, and in-class reasoning even when using AI tools to ensure that independent thinking is evident. There are some limitations to the study which detract from the interpretation. Limited to private secondary schools in Lahore, the convenience sample limited the generalizability to public schools, rural areas, other cities or all adolescents in Pakistan. Secondly, it was a cross-sectional study. While there is a positive correlation, it does not necessarily mean that AI usage brings better focus or critical thinking, as there could be a reverse relationship and other factors. Third, the main variables were all assessed using self-report questionnaire items, which means that they may represent perception, social desirability or common-method bias rather than actual cognitive functioning. Fourthly, the three sections of the questionnaire are not completely validated or reported in terms of internal consistency coefficients. Reliability analysis (e.g., Cronbach's alpha or omega) should be conducted on an original data set prior to submission to journal as should be construct validation (where available). Fifth, the thesis claimed that one of the aims was to find out how well the memories were retained; but there is no specific memory retention scale on the questionnaire or in the results reported. Hence, the retention of the memory is not incorporated in this extracted paper. More research is needed to determine if evidence can be found of long-term cognitive change in the use of AI, and this could be accomplished through objective attention tasks, standardized critical-thinking metrics, academic-performance data, experimental or longitudinal designs.

6. Conclusion

The most of the students in Lahore private secondary schools participated in the study, who used the educational AI tools, and this was correlated positively with attention span and critical thinking. The critical thinking was significantly correlated with the use of AI and the attention span was also positively correlated with the critical thinking. These outcomes should not be a blanket endorsement or denial of using AI in the classroom. They explain that, when used in a learning environment where verification, independent thoughts, reflection and concentration are maintained, AI can be a useful learning tool. As this study is correlational, it is important to conduct future studies to establish if there is an improvement, no change or damage when using

AI. In today's practice, it is recommended to use AI in a balanced manner, relying on guidance from teachers and for cognitive learning, not automated answers.

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