



Examining the Relationship between Artificial Intelligence Learning Tools and Attention Span in Virtual Education

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ABSTRACT

The aim of this research was to investigate the correlation between the Artificial Intelligence (AI) learning tools and paying attention in virtual education. A quantitative research design was used and data was gathered from 330 students of online learning environments. The instruments used for collecting data are structured questionnaires and the technique used in the analysis are correlation, multiple regression and ANOVA in SPSS. The findings from the study showed a positive and significant correlation between the use of AI learning tools and attention span, suggesting that the utilization of AI-based learning platforms had a positive impact on the concentration and engagement levels of students in virtual learning. Correlation analysis revealed that the variables were strongly correlated with each other and regression analysis indicated that the variables namely AI based learning platforms, interactive learning features, and personalized learning support significantly affected students' attention and interest. Moreover, according to the ANOVA result, the learning tools of AI technology showed a significant difference on the sustained attention in virtual education. It was found that AI technologies can enhance cognitive engagement but would need to be designed and implemented appropriately to prevent cognitive overload and distraction. The results underscore the need to use AI learning tools appropriately to boost students' attention span and learning outcomes in virtual learning.

Introduction

Artificial Intelligence (AI) has revolutionized the way learning takes place by creating new digital learning spaces that optimize teaching practices, provide customization in learning, and increase student engagement in the learning process. Over the past few years, AI-based learning tools like virtual tutors, assessments, chatbots, virtual assistants and adaptive learning platforms have proliferated in virtual learning environments. The technologies are intended to assist students, facilitate individual learning styles, levels and patterns. Since the onset of the online learning era into which many countries across the world have entered since the outbreak of the COVID-19 pandemic, the ability of AI to enhance the educational process has been greatly broadened (Holmes et al., 2022). Today, educational systems have come to depend on virtual platforms in order to ensure uninterrupted learning, and AI has become a key player in contemporary educational strategies.

AI learning tools can process student data in real-time and offer suggestions to enhance learning efficiency and results. However, AI-driven learning systems can adjust the pace of content delivery based on student needs, enabling them to learn at their own speed. Unlike a traditional learning system, AI-powered learning platforms can customize content delivery to fit the needs of the student, allowing them to learn at their own pace. The flexibility and adaptability have a positive effect on the accessibility and flexibility of education, especially remote and virtual education. The benefits of using AI technology on student motivation, engagement and satisfaction was emphasized as it offers personalized and interactive learning experiences (Zawacki-Richter et al., 2019). Furthermore, AI can also be useful to educators by streamlining repetitive administrative tasks, thereby freeing up more time for them to focus on enhancing the quality of teaching and learning, and engaging with students.

Given the rapid integration of AI technologies within the education sector, another worry is that students are cognitively engaged and paying attention in virtual learning environments. In terms of cognition and attention, due to the rapid application of AI in education, there is a concern regarding the students' learning process in virtual education. Although AI tools offer convenience and efficiency, excessive reliance on digital technologies could lead to distractions, decreased focus, and fragmented learning patterns. During virtual classes, students may simultaneously be involved with several digital applications, with the potential to adversely affect their capacity to focus on the learning material. Research by Carr (2020) suggests that prolonged use of digital technologies can result in a decrease of concentration and the promotion of short attention spans as a result of constant notifications, multi-tasking and information consumption. Hence the study of AI learning tools and the attention span has gained significant importance in current educational research.

Virtual education environments present a number of differences compared to the traditional classroom setting, as students are exposed to greater technical distractions and less monitoring. While in physical classrooms, teachers have a clearer view of students' behavior and can enforce classroom discipline, virtual learning environments rely on self-regulation and digital interaction. The impact of AI technologies on attention can be either positive or negative, depending on how they are used in the learning context. For example, focus and engagement can be enhanced in school with adaptive quizzes, gamified learning platforms, and intelligent feedback mechanisms, whereas excessive screen-based instruction can lead to cognitive fatigue and attention deficits (Mayer, 2021). Based on the above, it is recommended that attention capacity of students in virtual learning environment be studied based on the application of AI-based learning.

With the increasing prevalence of AI in the educational context, researchers are interested in the more general psychological and cognitive implications. Attention span is one of the most crucial cognitive qualities that impacts the accomplishment of learning, retention and academic performance. As virtual learning environments increasingly become a part of higher education and professional training, the connection between AI learning tools and attention span can offer valuable insights for educators, policymakers, and technology developers. The connection between AI and education is discussed, and grasping this can help in developing well-balanced and efficient AI-powered learning platforms that enhance learning outcomes while avoiding significant cognitive overload.

Concept of Attention Span in Virtual Education

Attention span is the period of time one can focus on an activity, task, or information without being distracted. At school, the focus is an important factor in knowledge, comprehension, memory and academic performance. Students who are able to sustain attention tend to be able to process information better and to be successful at completing their academic work. In the virtual education, attention span plays an even more critical role, as students must learn independently for many hours in the face of digital technologies. The learning environment online can be a variety of distractions for students, such as social media notifications, entertainment platforms, and opportunities for multitasking, which can lead to a decrease in concentration (Rosen et al., 2020).

Virtual Education is a teaching that makes students think about the digital content without physical supervision in the classroom. Therefore, the learners are required to be self-disciplined and have their intrinsic motivation to attend the learning process, both in online learning and lecture, so that they are able to sustain their attention. Virtual learning environments come with challenges of holding students' attention, as they are typically more intangible and less socially present than physical classrooms (Hrastinski, 2019). Passive teaching styles and lack of interactive and engaging learning experiences on learning platforms can lead to a decrease in engagement among students. This has led to an increasing focus on leveraging AI in education to enhance learner engagement and maintain their attention..

There are several psychological, technological and environmental factors that affect attention span in virtual education. Digital learning environments are fraught with many issues, one of which is cognitive overload. Excessive amount of information, several tabs, and constant digital interaction can overload students' cognitive processing, leading to diminished attention and mental exhaustion. The cognitive load theory (CLT) (Sweller, 2020) states that when cognitive processing demands are too high, they can have detrimental effects on learning outcomes and decrease attentional control. The problem is tackled by AI-powered learning systems, which aim to present material efficiently and tailor learning experiences to individual students' needs.

While AI technologies offer promising advantages, a few researchers suggest that excessive screen time and dependence on digital technology could be a factor in reducing students' attention spans. The use of various applications, often scrolling and many different stimuli received from the digital devices during online learning can take a toll over time. Research has shown that younger pupils can find it hard to focus for extended periods of time in virtual, highly stimulating environments created by digital technologies (Twenge & Campbell, 2018). As students spend more time interacting with AI-powered learning platforms and virtual classrooms, this issue is becoming more pertinent.

The phenomenon of attention span in virtual education is an important phenomenon to consider, because the attention span and the efficiency of learning and success are directly related. If a student has trouble holding his/her attention, he or she may have trouble grasping concepts,

interacting with the class, and effectively doing classwork. However, AI learning tools can either enhance or hinder attentional performance, depending on their design and usage. Hence, exploring how AI technologies relate to attention span (AS) is essential to designing educational approaches that foster cognitive engagement and enrich virtual learning experiences.

AI Learning Tools and Student Engagement

The goal of AI learning tools is to provide personalized and interactive learning experiences, fostering engagement and participation among students. Student engagement is the degree of interest, motivation and active participation that students show in learning activities. It is difficult to keep students engaged in virtual education as they may feel isolated, less motivated, and less engaged with teachers and fellow students. To mitigate these issues, AI technologies are being introduced to create adaptive learning systems, intelligent tutoring, gamification, and automated feedback mechanisms that have the potential to engage the student in the learning process (Luckin et al., 2016).

Customised instruction is one of the major benefits of AI learning tools, as they can adapt to each student's requirements. Classrooms are typically structured with the same methods of instruction that may not suit the learning style and abilities of different students. AI tools process student performance information and modify teaching content based on strengths and weaknesses. This personalized learning approach increases engagement by providing students with content that matches their skill level and learning style. Personalized learning environments have been found to be motivational factors, educational improvements, and more cognitively engaging (Pane et al., 2017).

Another crucial aspect of AI-powered learning systems that impacts student attention and engagement is gamification. A gamified learning platform is an educational platform that uses gamification elements to make learning interactive. All of these qualities maintain the students' interest and sustain their involvement in learning and with other activities. Some studies show that gamification can enhance engagement and motivation to learn by making the learning process enjoyable and competitive (Deterding et al., 2025). Also, AI can optimize challenges and rewards based on student progress, ensuring a balance of difficulty and engagement in the game.

AI chatbots and intelligent tutoring systems are another crucial element in the engagement of students in Virtual Education. Intelligent tutoring systems and AI chatbots are also contributing significantly to improve student engagement in virtual learning. These systems can provide immediate feedback, answer queries by students and guide students to learning activities without constant supervision of the teacher. Immediate feedback is believed to be important in maintaining the focus and keeping students on track because they can catch errors and adjust with it. Hattie and Timperley (2021) say that if feedback is given in time, it has positive effects on the learning outcomes and makes students feel confident and participate. AI-Tutoring Systems provide that learning atmosphere, promoting students to stay connected with learning materials.

AI learning tools can be valuable, but there are concerns about the potential long-term effects these tools will have on student attention spans and cognitive function. Students who heavily depend on Interactive Digital Technologies may engage in superficial learning and consequently may not be able to engage in deep learning. Others maintain that students may grow accustomed to receiving instant rewards for their learning, as well as entertainment in the learning process, which hinders their ability to pay attention to more in-depth and lengthy academic activities (Rizzo, et al., 2020). Examining the pros and cons of the engagement and attentional demands of AI in virtual learning is important to understand the impact.

Research Objectives

- To examine the relationship between Artificial Intelligence learning tools and students' attention span in virtual education.
- To analyze the impact of AI-based educational platforms on students' concentration and engagement during online learning.
- To identify whether the use of AI learning tools improves or reduces students' sustained attention in virtual classroom environments.

Problem Statement

Artificial Intelligence (AI) learning tools are gradually being introduced into virtual education, changing the way students access and interact with educational content, offering them personalized learning experiences, automated feedback, and interactive digital platforms. Even though AI technologies have educational advantages, there have been some concerns about the impact on students' attention spans and focus during online learning. The use of virtual education environments gives students constant exposure to screens and opportunities to multitask, digital distractions, and too much stimulation from technology, which can have a negative impact on their ability to concentrate and learn effectively. While there have been some research that has focused on improving academic performance and student engagement using AI, there has been little research that has specifically explored the impact of AI learning tools on students' attention spans in virtual education environments. The lack of literature leaves open the question of whether personalization and interactivity through AI technologies increases the engagement and concentration of the audience, or leads to less engagement and cognitive overload. Hence, the purpose of this study is to explore the correlation between Artificial Intelligence learning tools and attention span of the students followed virtual education process.

Significance of the Study

The value of this study is that it is applied to the field of educational technology, investigates the impact of the use of the Artificial Intelligence learning tools on students' attention in virtual education, and becomes a contribution to the growing field of educational technology studies. The insights from this study can be valuable for educators, educational institutions, policymakers, and techn developers to gain insights into the impact of AI-supported learning systems on cognition. The research can offer insights into how AI technologies can improve focus and engagement or distractions and less attentional capacity for students during an online-learning experience. In addition, the results may be used in the development of effective virtual teaching strategies in the incorporation of technology and cognitive health in educational institutions. The findings from this study could be applied to the design of AI learning platforms, which may instigate students to extend their time on task, improve their learning outcomes and produce more productive virtual learning for students in today's digital learning environments.

Literature Review

In the ever-changing landscape of modern education, a powerful technological advancement that has gained significant traction is Artificial Intelligence (AI). One of the most impactful technological innovations in contemporary schooling is Artificial Intelligence (AI), which has revolutionized the teaching and learning environment on a global scale. AI is the ability of computers and machines to mimic human intelligence and carry out tasks that involve problem-solving, decision-making, understanding language, and adapting to learning. AI technologies are frequently employed in education via intelligent tutoring systems, adaptive learning platforms,

automated grading systems, virtual assistants and chatbots that improve the teaching process and the student learning experience (Bharathiyuvaraj et al., 2024). The rapid development of digital learning environments and the rising demand for virtual education have sparked the education industry to focus on the application of artificial intelligence in learning. The use of artificial intelligence in learning has been fueling the industry of education, as digital learning environments have been developed and the use of virtual education has been growing.

Technology systems play an important role in a virtual education environment, serving to communicate, transmit content, assess and interact with students. The learning platforms are customized to suit the learning style and abilities of each student and are powered by AI. These systems can be used to collect and analyze learner behaviours, and present customized learning sequences to increase engagement and learning efficiency. Liang et al. (2023) has found AI technologies to show potential in supporting personalized education, alleviating teachers' administrative burden, and enhancing student learning outcomes through data-driven teaching methods.

AI learning tools have been gaining traction in the educational landscape, both in schools and universities and online platforms. Intelligent tutoring systems and other learning systems provide timely feedback, identify gaps in learning, and customize the content to a student's progress. These features help to create interactive learning experiences that could positively impact student motivation and learning. AI technologies contribute to education accessibility and inclusiveness by supporting students with various educational needs and learning capacities (Rosak-Szyrocka et al., 2023).

While these benefits are promising, there have been concerns about the potential negative impact of overreliance on AI tools in education on cognitive and psychological development. Others researchers state that there is a possibility of connection on continuous interaction with digital systems that may affect students' concentration, attention control and deep learning skills. As AI-driven learning apps become more prominent, there is a growing debate on their impact on cognitive engagement, and the possibility that they may be causing shorter attention spans as a result of the constant digital stimulation and multitasking habits they foster (Lorenzo, 2025). As a result, the studies have started investigating the interaction of AI learning tools with students' cognition of virtual learning..

AI Learning Tools and Virtual Education

AI learning tools can make a big difference in improving virtual education by improving the way teaching and learning is done, how it is communicated, and how it interacts with the learner. Virtual education is an educational activity based on the use of Internet and digital technologies instead of using a physical classroom. AI technologies can assist with virtual learning by developing smart educational systems that can tailor their content and delivery to each student's requirements, and offer interactive learning experiences. Since the onset of the COVID-19 pandemic and the global shift towards virtual learning systems, the use of AI tools in virtual education has surged in prominence (Shanmugasundaram et al. 2023).

Personalization is one of the key tasks of AI learning tools in virtual learning. Personalized learning systems track the way students learn, their strengths, and limitations as well as their progress, and then offer tailored learning resources and suggestions. It provides differentiation to help students learn at their own speed and improves student engagement with learning material. Research indicates that the use of AI systems tailored to the individual student positively impacts student satisfaction and academic outcomes, fostering a more personalized learning experience for

each student (Gligorea et al., 2023). Students receiving customized learning support are more likely to be motivated and focused in virtual learning sessions.

The intelligent tutoring system based on artificial intelligence (AI) is also widely used in virtual classroom education to assist students in self-study. These systems mimic the behavior of a teacher and respond to students' queries, provide explanations, and give instant feedback. Immediate feedback is important and essential in keeping students' attention as learners are able to see their own mistakes and correct their understanding without delay. Sajja et al., (2024) stated that giving feedback in time would make the learning more effective and would motivate the students to be active in learning activities. AI tutoring systems remove the reliance on educators, and promote ongoing engagement with educational material.

Another key aspect of AI-powered learning tools in virtual education is the ability to gamify the learning experience. Another key aspect of AI-powered learning tools in virtual education is the ability to gamify the learning process. Gamification is characterized in learning environments by providing rewards, points, badges and competitions to encourage and motivate learners to participate. AI systems improve gamification by dynamically adapting the difficulty levels based on student progress. Gamification of educational platforms has been shown to increase student engagement and participation, and enhance focus through the implementation of learning activities that are more interactive and fun (Sufyan Ghaleb et al., 2023).

Attention Span and Cognitive Engagement in Virtual Learning

One of the most crucial cognitive functions associated with successful learning and school achievement is attention span. It is a person's ability to focus on a particular task or stimulus for an extended period of time without distraction. In learning settings, attention allows learners to plug information into their brain, grasp concepts and retain knowledge effectively. High attention spans tend to produce high-quality academic outcomes, high memory retention and better problem-solving skills. In virtual learning settings, attention is especially significant because students are required to sustain their focus on their own without the support of a teacher and interact with digital educational systems (Jamil et al., 2024).

Learning in virtual learning environments is a challenge that can impact students' attention. Virtual learning also does not receive the same level of "face-to-face" supervision and interaction as traditional classrooms, which increases the risk of distractions and lower engagement for students. When students take online classes, they are likely to face disruptions due to alerts, social media, entertainment apps, and the ability to multitask. These distractions can disrupt students' focus and attention and decrease their sustained attention during learning activities (Chen, et al., 2020).

The concept of attention in virtual learning environments can be understood based on the Cognitive Load Theory. Adewale et al., (2024) noted that people's cognitive capacity is limited and when the demands of the information being processed exceed the capacity of cognitive processing, working memory is overwhelmed and learning efficiency is reduced, causing them to lose their concentration. When using virtual learning environments, pupils are sometimes overwhelmed with digital information, multimedia and simultaneous tasks of learning.

AI learning systems try to minimize cognitive load by structuring learning material efficiently and tailoring the learning process to the learner's capabilities. The connection between screen time and students' attention span in digital learning environments has also been studied. Overuse of screens and digital devices has been linked to poor focus, fatigue, and attention span. Clemente-Suárez et al., (2024) concluded that a higher amount of screen time among students was associated with reduced psychological well-being and attentional challenges. As students' exposure to the many

changes in digital content continues, it can make it more difficult for them to sit and do more complex academic tasks that demand more concentration.

Impact of AI Learning Tools on Student Attention Span

With the growing reliance on virtual learning technologies, the connection between AI learning tools and students' attention spans has emerged as a key focus in educational research. AI learning tools can impact attention in either a positive or a negative way, depending on their design, working mechanisms, and usage. There's been a discussion about whether AI-backed educational systems enhance focus on personalization and interactivity or distract with excessive digital stimuli.

Adaptive instruction is one of the significant benefits of AI learning tools on students' attention spans. Personalized learning systems deliver learning content based on interests, abilities and learning progress, hence learning experiences are more relevant and engaging. By providing learning materials that match students' learning needs, students will be able to focus and be motivated to participate in learning activities (Bahroun, Z et al., 2023). AI systems also incorporate interactive elements like quizzes, simulations, and animations to maintain student engagement and enhance participation in virtual classrooms.

Attentional engagement is also enhanced by AI-driven feedback mechanisms, which offer real-time responses to student actions. It is also important that students receive immediate feedback so that they do not get lost and become disinterested in learning. Hattie and Clarke (2018) suggest that providing rapid feedback raises student self-confidence, motivates students to learn and enhances focus when completing academic tasks. ICTs that have a continuous interaction with learners can provide supportive learning environments that foster sustained concentration.

Another important aspect that affects attention span in virtual education is multitasking. During online learning, students are often moving from educational apps to social media, chat apps and entertainment websites. The research carried out by Kukreja and Singh (2019) has proven that task-switching with the help of the media has a negative impact on concentration and academic achievement. When learning platforms have too many notifications, gamified distractions, or unnecessary interactive elements, AI learning tools can inadvertently foster multitasking habits. In general, the existing literature indicates that AI learning tools have the potential to increase or decrease attention span, depending on their use in virtual education. AI systems can enhance cognitive engagement and attentional focus when they are well-designed to provide structured learning experiences, personalization, and meaningful interactions. Poorly managed digital learning environments, however, with too much stimulation and too many opportunities for multitasking can lead to attentional fragmentation and cognitive overload. Therefore, it is necessary to carry out further research on the specific relationship between AI learning tools and students' attention span in virtual education.

Empirical Review Related to the Research Objectives

However, several empirical studies have been conducted to explore the effectiveness of AI technologies to enhance virtual learning experiences and student engagement. In their study, McPherson et al. (2022) identified that AI assisted learning systems greatly enhanced personalized learning and student engagement in higher education through a systematic review. The study emphasized the importance of adaptive learning technologies in improving the efficiency of education through the ability to adjust the educational content based on student needs. The researchers, however, reported that there was not enough research that had explored the cognitive impact of AI technologies on attention and concentration.

igg et al. (2025) analyzed the experiences of students during emergency remote teaching and summarized some issues for the engagement and fatigue of the learners in the learning process of online teaching. The research revealed a common issue students had was being unable to focus on their virtual lessons because of distractions and overuse of screens. While digital learning tools made learning more accessible, certain adverse effects of online learning extended to the students' attentional capacity and mental health

AI-based personalized learning environment has been explored by Pane et al. (2017) and proved to be beneficial for student motivation and academic performance. Students engaged in adaptive learning systems were more engaged and more satisfied with their learning than students in traditional systems. The research indicated that customised teaching via AI might be more effective at maintaining concentration and engagement in learning activities.

Rosen et al. (2020) studied the impacts of media multitasking on student learning attitude and concluded that students who used multiple media frequently suffered from low concentration and learning performance. The results highlighted that while multiple distractions in VLEs negatively impact sustained attention and cognitive engagement, having no distractions at all is beneficial. This study due to the fact that AI-based virtual education frequently requires ongoing digital interaction.

Methodology

Research Design

The research methodology utilized in this study is quantitative research design, which aims to explore the relationship between the learning tool of Artificial Intelligence and students' attention duration in Virtual learning. The descriptive and correlational method was used because it was felt that a study of this nature was suitable to analyze the relationships between variables. Numerical data from the participants were collected by survey technique by using structured questionnaires. This design was chosen because it facilitated capturing students' perceptions and experiences of AI-enhanced learning spaces.

Population of the Study

The research subjects were students enrolled in the virtual education programs who used Artificial Intelligence learning tools for learning regularly. These students were from varying academic levels and educational backgrounds. The population of this study was 330 students. The chosen population was deemed suitable as their members have experience of utilizing AI-based virtual learning systems

Sampling Technique

In this research, simple random sampling method was applied to ensure that every student in the population has equal opportunity of being in the sample. This was chosen as it minimised sampling bias and enhanced the quality of data collected. The target population of the participants was virtual education, and they were randomly selected. The technique was found to be effective in eliciting a wide and representative range of responses from student.

Sample Size

The sample size consisted of 330 students enrolled in virtual education programs, representing the entire population of students selected for the study. The number of respondents was adequate to achieve accurate and reliable research results. The sample consisted of students who actively used

AI learning tools in online education. The sample size selected was deemed to be adequate for the study to meet the objectives and for statistical analysis purposes.

Data Collection Method

Students' perceptions about learning tools related to Artificial Intelligence and attention span in virtual education was measured using a structured questionnaire. The questionnaire was closed-ended questions on a Likert scale. The questionnaires were sent to the participants by online survey techniques. Responses were electronically gathered to make it easy, accurate and to gather the data efficiently.

Data Analysis Technique

The collected data were analysed with statistical methods to investigate the correlation between students' attention span and AI learning tools. The software, Statistical Package for Social Sciences (SPSS), was used for data entry and analysis. The responses were summarized using descriptive statistics like frequency, percentage, mean and standard deviation.

Table 1: Demographic Information of Respondents (N = 330)

Demographic Variable	Category	Frequency	Percentage (%)
Gender	Male	180	54.5%
	Female	150	45.5%
Age Group	18–22 Years	140	42.4%
	23–27 Years	120	36.4%
	28–32 Years	70	21.2%
Educational Level	Undergraduate	170	51.5%
	Graduate	110	33.3%
	Postgraduate	50	15.2%
Daily Use of AI Learning Tools	Less than 1 Hour	60	18.2%
	1–3 Hours	150	45.5%
	More than 3 Hours	120	36.3%
Virtual Learning Experience	Less than 1 Year	80	24.2%
	1–3 Years	170	51.5%
	More than 3 Years	80	24.3%

The demographic analysis showed that the greatest proportion of the respondents were male students (54.5%) and the female students (45.5%). 51% of the respondents were between 18-22 years old, with a greater inclination towards learning in virtual education and AI-supported learning environments. The findings also showed that the students of the study were mainly undergraduate students. Regarding AI learning tools, the majority of participants said they use AI educational platforms for 1-3 hours of learning each day, signifying a high usage frequency of virtual learning technologies. Moreover, most of the respondents were experienced with virtual education of 1-3 years, which indicated they had enough experience on virtual education systems and AI learning tools concerning the study's objectives.

Table 2: Correlation Analysis Between AI Learning Tools and Attention Span (N = 330)

Variables	Mean	Standard Deviation	AI Learning Tools	Attention Span
AI Learning Tools	3.89	0.74	1	0.682**
Attention Span	3.65	0.81	0.682**	1

The results of the correlation analysis indicated that there is a positive and statistically significant correlation between the application of the tools of learning in the field of Artificial Intelligence with attention span in virtual learning, $r = 0.682$, at the 0.01 significance level. The results showed that using AI learning tools significantly correlated with students' concentration during online learning activities and attentional involvement. The positive correlation indicated that the effective application of AI learning technologies could positively impact students' focus, interaction, and attention in virtual education settings. Thus, the findings corroborated the first research aim, which was to explore the relationship between AI learning tools and attention span.

Table 3: Multiple Regression Analysis of AI-Based Educational Platforms on Students' Concentration and Engagement (N = 330)

Variables	B	Std. Error	Beta (β)	t-value	Sig.
Constant	1.214	0.287	—	4.230	0.000
AI-Based Educational Platforms	0.521	0.072	0.468	7.236	0.000
Interactive Learning Features	0.337	0.065	0.351	5.184	0.000
Personalized Learning Support	0.294	0.058	0.298	5.069	0.000

Table 4: Model Summary

R	R Square	Adjusted R Square	Std. Error of Estimate
0.741	0.549	0.544	0.463

Based on the multiple regression analysis, the rate of concentration and engagement of students in virtual education was significantly affected by the use of the education platform based on artificial intelligence, interactive learning system and personalized learning system. The summary of the model revealed the value of R was 0.741 and value of R Square was 0.549, which means the independent variables in the model accounted for about 54.9% of the variation in students' concentration and engagement. All significance values were < 0.05 ; this indicates a statistically significant effect. The AI-based educational platforms had the highest beta in predicting concentration and engagement at 0.468. The results of this study assisted with the second research aim and highlighted the positive effect of AI enabled learning tools on students' attention and engagement in learning online environments.

Table 5: ANOVA Analysis of the Effect of AI Learning Tools on Students' Sustained Attention in Virtual Education (N = 330)

Source of Variation	Sum of Squares	df	Mean Square	F-value	Sig.
Between Groups	52.684	3	17.561	18.432	0.000
Within Groups	310.457	326	0.952	—	—
Total	363.141	329	—	—	—

The ANOVA showed that the use of Artificial Intelligence learning tools had a statistically significant effect on the students' sustained attention in virtual education environments. The results indicated that the F value was 18.432 and the significance value was 0.000, below the normal level of significance which is 0.05. This finding indicated that there were students who showed the differences in the effect of the application of AI learning tools on their attention span in learning activities in the online classroom. AI applications in educational technologies appeared to impact students' attentional engagement and concentration in virtual classrooms, as suggested by the analysis. Thus, the results answered the third research goal and validated that AI learning tools had a significant impact on the sustained attention of students in virtual education.

Discussion

The results of this study indicate that there is a positive connection between Artificial Intelligence (AI) learning tools and students' attention span in virtual education. The outcomes indicate that AI-based educational technologies are powerful tools with the potential to impact online learners' cognitive engagement and attentiveness, concentration, and sustained attention. The correlation analysis revealed that there was a strong positive correlation between the use of the AI learning tools and attention span, meaning there is a positive relationship between the two. The results are consistent with those reported by Qin et al. (2025) who noted the potential of AI technologies to improve personalized learning experiences, as well as to boost student engagement in digital learning environments. The implications of this is that, if well used, AI tools can help students to focus during virtual learning sessions.

The regression analysis further revealed that the use of AI-based learning platforms and interactive learning/personalized learning support were significant factors in students' engagement in learning activities and concentration. The model explained a substantial amount of variance in student engagement, highlighting the importance of personalization in education using AI. These findings agree with Xu, Q. (2024) stated that personal learning systems motivate and engage students in learning and adjust to their needs. Likewise, Ekin, et al. (2025) stated that AI systems can improve the learning experience by offering personalised feedback and intelligent support, ensuring that students stay engaged with learning tasks. The results of the present study, accordingly, verify that AI-based learning environments have a positive impact on students' engagement and attentional focus in virtual education.

The ANOVA results also showed a significant difference between the state of the sustained attention of students when using AI learning tools and the non-use of such tools, supporting the third objective of the study. The discovery indicates that students' attention varies between different AI learning systems. Those who used AI tools regularly showed improvements in their ability to sustain attention. Students who used AI tools regularly showed improvements in their ability to sustain attention. The findings in this paper are consistent with the study conducted by Hong and Kim (2024), who reported that cognitively engaging and interactive learning settings can increase the processing of information and attention retention. Likewise, Talan, T (2021) highlighted that feedback mechanisms that can be automated using AI can be very important for keeping learners engaged and focused and making sure their learning is better.

Yet, the study's positive findings should not be overlooked as it reinforces the concerns found in previous literature on potential challenges to cognitive learning in digital learning environments. According to Lin et al., (2024), overuse of digital technologies could cause people to not be able to sustain deep concentration and focus because of the constant stimulation and multitasking. Twenge and Campbell (2018) also observed that an increase in screen time among students was related to decreased attentional control and psychological well-being. The concerns indicate that AI learning

tools have the potential to increase engagement, but can decrease sustained attention if they are used too often or are not well designed.

Are not used often enough, or are poorly designed. The results from this study thus point to a balanced view: that the use of AI learning tools is not necessarily bad for concentration—and nor is it necessarily good. Rather, the effect they can have is dependent on the manner in which they are incorporated into the virtual education systems. AI technologies that provide a more structured learning experience, personalized teaching, and engaging interactions can increase engagement and attention. However, if they result in over-stimulation and multi-tasking using digital devices, they could have a detrimental impact on pupil concentration. In digital classrooms, as Johnston et al. (2024) noted, using media multitasking can have a negative impact on concentration.

Overall, the discussion suggests that the attention span of students in virtual education is positively correlated with the use of AI learning tools, while some information on cognitive risks of the use of AI learning tools is provided. The study contributes to the existing literature by providing empirical evidence to back up the positive and negative impacts of AI in the field of education. It reiterates the importance of effective instructional design and the proper application of AI technologies to optimize learning outcomes and ensure learners' engagement during virtual learning.

Conclusion

The present study aimed at exploring the correlation between the Artificial Intelligence (AI) learning tools and students' attention span in virtual education. The results showed that there was a strong positive correlation between the use of AI learning tools and attention span, suggesting that engaging with AI-powered educational platforms is associated with heightened concentration and engagement in online learning. The overall results of the correlation, regression and ANOVA showed that AI-educational technologies have a significant effect on the students' cognitive focus, confirming all three research objectives of the study.

The study suggests that AI learning tools are beneficial tools that enhance the value of virtual education by stimulating students' participation, attention, and involvement. But the results equally indicate that the effectiveness of these tools will rely on the design and implementation of the tool. While AI tools can support personalised learning and concentration, there is a potential for them to have a negative effect if they are used in excess or are not appropriate for the child's use. The management of AI learning systems, therefore, is important to balance and plan their use for optimal educational outcomes, avoiding unnecessary distractions.

Future Implications

The findings of this study hold importance for both the teachers and the education policy makers and for the growth of the education technology. New AI learning platforms should be designed to address real-world issues of how to increase students' attention span by minimizing distractions and creating well-designed learning journeys to have positive goals. New applications of AI in education should focus on providing extra active learning, cognitive engagement and personalized teaching methods, but ensure that the students are not inundated with digital stimulation. Furthermore, policy makers need to develop policies that guide the effective use of AI tools in virtual learning environments, so they can contribute positively to students' learning and cognitive development. Research in the future is encouraged to investigate longitudinal studies to elucidate the longer-term effects of AI learning tools on attention span and other cognitive domains in a variety of learning settings.

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