Effects of Artificial Intelligence on the Academic Achievement of Undergraduate Students

Kamran Khan
MPhil Scholar, Department of Education, Abdul Wali Khan University Mardan
Email: kamranbacha263@gmail.com

Dr Samreen Mehmood
Assistant Professor, Department of Education, Abdul Wali Khan University Mardan
Email: samreen@awkum.edu.pk#gernc2025

Dr Hafiz Muhammad Irshadullah
Associate Professor, Department of Education, Abdul Wali Khan University Mardan
Email: drirshad@awkuk.edu.pk

Abstract
This study investigates the effect of Artificial Intelligence (AI) tools on the academic achievement of undergraduate students at AWKUM Garden Campus. With the rapid advancement of AI technologies, educational institutions are increasingly integrating these tools to enhance student learning outcomes. The primary objective of this research is to explore how AI tools, such as ChatGPT, Grammarly, and Google Bard, impact students' academic performance and to understand the relationship between the frequency of AI usage and academic success. The study also aims to analyze how AI tools affect students with varying levels of academic achievement. A quantitative research approach was adopted. A total of 200 students participated in the survey, providing valuable data for analysis. The findings were analyzed using descriptive and inferential statistics to draw meaningful conclusions. The results found that AI tools significantly improve students' academic performance, particularly in tasks such as writing assignments, research work, and exam preparation. The study found a positive relationship between the frequency of AI tool usage and academic achievement, suggesting that students who use AI tools more frequently tend to perform better academically. In conclusion, the study confirms the benefits of AI tools in enhancing academic achievement among undergraduate students. However, it also points to the need for further integration of AI tools into educational settings, along with guidance on how to use them effectively. Future research should explore the long-term effects of AI tool usage, the impact of AI on students with different learning styles, and how AI tools can be adapted for different academic disciplines.

Keywords: Artificial Intelligence, Academic Achievement, Self-Efficacy, AI Tools, Social Cognitive Theory, Academic Performance, Learning Tools, AI in Education,

Introduction
Modern education has included Artificial Intelligence (AI) as a powerful weapon in the education than ever before by providing personalized learning experiences, adaptive feedback system and intelligent tutoring platforms. Since the AV integration of ChatGPT, Grammarly, QuillBot, and Google Bard into learning process has changed dramatically how learners interact with academic content and make assignments. These tools help shape up complex learning tasks, furnish immediate feedback, to facilitate

understanding, comprehension and writing quality (Anderson, 2009). The adoption of AI roles grows in the higher education especially in undergraduate students who use these tools to do research writing, grammar correction, presentation development and exam preparation (Luckin et al., 2016). Through the studies in the application of AI in education (Zawacki-Richter et al., 2019), it is possible that AI could increase the learning efficiency and student engagement. Nevertheless, despite the rise of AI in educational settings, as yet, the effect that such tools can yield on academic performance is still being argued. Technological advancement and augmented digital literacy is what has brought about the adoption of AI based educational tools in Pakistan. Since more and more undergraduate students start utilizing AI tools in their educational routine, one should understand how AI tools influence students' academic achievements. AI technologies are mentioned to improve the outcome through personalized support and scaffolding in the academic level (Chen et al., 2020).

Statement of the Problem
The popularity of such AI tools amongst the students although is increasing but there is almost no empirical research to assess whether the tools actually impact on the academic performance; particularly in developing like Pakistan. According to some, who then attribute improved grades and learning efficiency to the agency, and others, sceptical of the effectiveness of the agency. Furthermore, it is not known to which extent these tools help all students equally or to what extend their effectiveness is dependent on students past academic performances. This study fills the gaps by means of a structured quantitative analysis.

Objectives of the Study
1. To find the effect of the Artificial Intelligence tools on the students' achievement at undergraduate level.
2. To investigates the relationship between frequency of use of AI tool and academic achievement of undergraduate students.

Research Questions
1. How do undergraduate students fare in their academic ability when exposed to use of AI tools?
2. What is the connection between how much AI tool is used and academic success?

Significance of the Study
The significance of this study lies in understanding how use of AI tools impacts undergraduate student's academic success. It offers data driven insights towards educational, institution and policy level for the effective use of AI in academic architecture. This study can inform policies that assist equity in digital learning and sensible utilization of AI in higher education by specifying patterns of usage and effectiveness.

Literature Review
As already defined in the mobile app's definition, Artificial Intelligence (AI) involves the simulation of human intelligence processes by machines, most notably computer systems. As a tool in the area of education, AI is employed for smart systems to perform tasks know problem solving, language processing, adaptive learning, and predictive

analytics (Holmes, Bialik & Fadel, 2019). With the application of AI into education, the traditional pedagogical approach is shifted to data driven student centered learning environment that is having individual character. Intelligent Tutoring Systems (ITS) is one of the application of AI to education; it offers personalized instruction and feedback without relying on the human intervention. They are systems that spend time analyzing students' responses, system tracking the students' progress, and changing the learning content that is provided based on students' response (Winkler & Söllner, 2018).

Besides, AI has allowed the use of such automated evaluation tools as automated essay scoring and real-time feedback systems. Not only are these tools a reduction in the work load of instructors, they provide students with timely, formative feedback which are known to increase academic work (Baker et al., 2010). Grammarly and Turnitin are not just tools for grammatical correction, but they raise academic writing and critical thinking in the students as well. Additionally, significant use of AI in education is in the use of learning analytics and predictive modelling to warn at risk students before they lose and even suggest possible interventions. These technologies help educators make decisions based on real time data (Binns, 2018). Just as an example, there are systems that can use AI to monitor attendance patterns, submission times and engagement to predict and might help inform student support services. Finally, chatbots and virtual assistants have been adopted as highly popular AI tools in education. Conversational agents can answer students' questions, give them guidance in their learning management systems and provide emotional support, especially in the realm of remote or digital learning (Winkler & Söllner, 2018).

In recent years, Artificial Intelligence (AI) has become recognized as a transformative tool not only to enhance the education experience in a more convenient way but also to contribute significantly to the performance of students in terms of academic achievement. In order for educational institutions to achieve the purpose of personalizing learning experience, increasing engagement, and increasing student performance, they utilize AI tools such as intelligent tutoring systems, adaptive learning systems, and real time feedback applications (Holmes et al., 2019). A lot of studies show that the more AI is integrated, the more successful is learning. To give just an example, Squirrel AI and Carnegie Learning have AI powering their systems that give personalized learning paths, the difficulty of the content is adjusted to match the performance. These systems facilitate mastery learning by pinning down and fixing individual learning deficits to help improve the student's academic outcomes (Zimmerman, 2002; Tavakol & Dennick, 2011). Certainly, students who interact with adaptive AI tools tend to retain the content better and have better test scores than the traditional ones.

Moreover, AI works in such a way that it is capable of providing timely and automated feedback which is imperative to effective learning. Self-regulation is encouraged and student ownership of learning is promoted through automated writing evaluation tools such as Turnitin or Grammarly (Roscoe et al., 2017). AI provides feedback systems that reduce the load on teachers as well as a more iterative and formative learning process which is related to greater achievement (Mayer & Moreno, 2003). One of the major impacts of AI in the field of educational system is in the area of predictive analytics, where AI algorithms help to predict the chance of students to fail in education or succeed in it based on their academic data. Early intervention based on these predictive insights are provided for educators by these insights so they may give additional support to struggling students (Murray, 2014). Such decision making with data as the driver has been demonstrated to be positively related to rates of academic persistence and

achievement. Chatbots and AI based academic advisor is also being commonly used, especially in the digital learning environment. The virtual agents are instant support, answer course related queries and help in the navigation of the learning management systems. Research shows that the more time an AI assistant is available 24/7, the more likely it is that students develop a higher level of confidence, motivation, and satisfaction and a higher level of students achieve academically (Winkler & Söllner, 2018).

Conceptual Framework
Conceptual Framework for this study includes a visual and a theoretical representation of the key variables and their relationship. It presents a clear picture of how Artificial Intelligence (AI) has an impact on the academic performance of undergraduate students based on existing theories and literature. And in this context, AI tools are considered a mediating variable in the relationships between the aforementioned variables and student learning through pathways such as personalized learning, self-regulation, motivation, academic performance.
Primary variables that the framework considers include:
1. Independent Variable: AI Tools
2. Learning Environment, Self-Regulation, Motivation as Mediating Variables
3. Dependent Variable: Academic Achievement

Research Methodology
To find out the nature and strength of the relationship between AI tool usage and academic achievement, a descriptive correlational research design was adopted. This design makes it possible to investigate association without changing the variables. According to Creswell (2014), correlational designs are ideal for evaluating a relationship between variables under conditions of the 'real life' setting.
Undergraduate students of Abdul Wali Khan University Mardan (AWKUM), Garden Campus is population of the study. A stratified random sampling was taken by using a sample of 200 undergraduate AWKUM Garden Campus. With this method we ensure that representation of departments (Social Sciences, Natural Sciences, Management Sciences) in the selection are made fairly. By department, the sampling frame was divided into strata, and respondents were randomly selected from each stratum. The data was collected by a structured questionnaire. Data was analyzed using SPSS via Descriptive Statistics (Frequencies, means, and standard deviations), Pearson Correlation, Regression Analysis and ANOVA.

Findings and Discussion
Findings Based on Objective 1: To Determine the Effect of Artificial Intelligence Tools on the Achievement of Undergraduate Students
Question: How significantly are you able to have attributed your academic performance to AI tools (such ChatGPT, Grammarly, Google Bard)?

Response	Frequency
Not at all	3
To a small extent	12
To a moderate extent	47
To a great extent	89
To a very great extent	49

Basic premise of this question seems to be that most students (69%) believe the academic

performance has been positively affected by AI tools. More than 40 percent of the students stated that the improvement in their academic performance was to the level of 'great' or 'very great'. This confirms that in the context of AWKUM Garden Campus, AI tools, especially those for helping in academic tasks like writing, research and content generation, are of value to the students.

Discussion: These findings are in agreement with the findings of Chen et al. (2020) that AI enhanced tools enable personalized learning environment to suit student's own pace of learning and receive targeted support based on the student's own academic need. It increases learner engagement as well as better academic outcomes in a wide range of disciplines and educational background (Azevedo & Hadwin, 2005).

Question : For which of the following academic tasks do you use some AI tools?

Task	Frequency
Writing assignment	180
Research work	158
Exam preparation	135
Presentation	121
None of the above	52

The most common type of academic activity where students use AI tools is writing assignments (180), then research work (158). There are also a considerable number of students who use AI tools for exam preparation (135), presentations (121), which suggests that AI is not only helpful in helping with written assignments but also is also important in both preparing for exams and developing presentation materials. Least of all got picked 'None of the above' (12 students) indicating that AI tools were widely accepted and used for in all academic domains. It fits a trend where AI is becoming more integrated in the educational activities and students are relying increasingly on AI for both research and output.

Discussion: Besides, the study also demonstrated that AI covers exam preparation and presentation. So, it seems that students don't only use AI tools for written assignments; on the contrary, they perceive them to be equally effective in all fields of study. Students apply the use of AI in each of their study aspects to learn in more efficient and optimized period of time. Holmes et al., (2022) assertion that AI tools are flexible and can be adapted by offering support for many academic, including the creation of content, to preparation for exams, seems to be supported by this finding.

Question: Are you satisfied with your grades after using the AI based tools?

Responses	Frequency
Strongly Disagree	5
Disagree	15
Neutral	42
Agree	83
Strongly Agree	55

According to the results, 69 per cent of students agree or strongly agree that their grades improved since the use of AI based tools. Only 20% of students disagreed or neutral on how AI will influence their grades. This very strong positive correlation between the use of AI and how well students do in their grades is something that is suggestive of AI tools directly contributing to academic success either by providing a better quality of assignments or helping students prepare better for exams and assignments.

Discussion: This is consistent with the argument of Holmes et al., (2022) that AI's capacity to help students write on tasks has direct bearing on better academic outcomes. Moreover, AI tools lessen the cognitive burden of academic tasks by making them appear simpler by doing work required to be done, for example, proofreading or structure of the content. Such implementation has allowed more mental resources to students and be dedicated to higher order cognitive functions, such as critical thinking, creativity and problem solving, which are basic requirements for deep learning and academic success. One such example is when as students are relieved of the tiring and repetitive tasks so these students get more time for such complex processes to excel in assignments, exams, project, and may scores.

Objective No 2: To Examine the Relationship Between the Frequency of AI Tool Usage and the Academic Achievement of Undergraduate Students
Question 1: How many times do you employ the use of AI tools for academic work??

Response	Frequency
Never	2
Rarely	10
Sometimes	42
Often	82
Always	115

Analysis: Seven out of ten students (67%) have resorted to using AI tools to get things 'done,' 'often,' 'always,' or at least 'sometimes.' So, only 14 percent of students said rarely or never use AI tools, and 19 percent say they use them now and then. This implies a very high penetration of the use of AI tools by students in AWKUM Garden Campus, thus implying these are being used as part of their routine activities. Therefore, the high AI tool usage is related to their accessibility and utility. Students might find these tools very useful to complete their academic works in a more efficient and effective manner with such tools as ChatGPT for content generation, Grammarly for writing support, Google Bard for research.

Discussion: If AI tools are used frequently in academic works, it implies that students are becoming increasingly aware of how the benefits these tools bring to improve their learning process. If students are more likely to use AI tools starting from writing, research, exam preparation, then they would have a more smooth academic process. This is in agreement with previous studies (Zawacki-Richter, et al., 2019) that also found that frequent use of AI tools leads to positive relationship with learning outcomes.

Question 2: How many hours per week on average do you spend using AI tool for your studies?

Response	Frequency
Less than 1 hour	3
1-3 hours	25
4-6 hours	61

| 7-10 hours | 76 |
| More than 10 hours | 41 |

Analysis: There is data that shows most of the students (59%) use AI tool for educational purpose from 4 to 10 hours every week. So, 61 students spend between 4 and 6 hours and 76 spend between 7 and 10 hours weekly using AI tools. Less than 3 percent of the students use AI tools less than one hour a week whereas 41 students (19 percent) spend more than 10 hours a week the AI tools. If the rate of students using AI tools for several hours each week is significant, it's a safe bet to say that these tools are part of everyone's academic workflow. Saving time on simple tasks such as grammar checking and research, AI tools may take up students' time for more advanced academic activities, bettering performance.

Discussion: Indeed, the amount of time students spend using AI tools can actually suggest just how reliant they have become on these tools to be successful academically. AI tools eliminate the loss of time spent on performing repetitive tasks so students can spend more time on studying, critical thinking and deep learning. The activities above are important for better academic outcomes. The finding matches that laid out by Winkler and Söllner (2018), who found that the more students used AI tools, the better they performed academically since this tool improves students' learning experience. Interestingly, although the proportion of students spending more than 4 hours a week using AI tools is relatively high, it confirms that these tools must be felt as necessary for academic success.

Question 3: Have you noticed any such link between how often you used AI and how good your academia is?

Response	**Frequency**
No link	8
Slight link	25
Moderate link	52
Strong link	74
very strong link	43

Analysis: The majority of students (71%) had found a positive correlation between the frequency of use of their AI tool and their academic outcome. Of those 74, 43 students said there was a very strong link and 74 students had a strong link. However, 33 students (29%) stated that they did not realize there was a direct relation between the use of AI tools and their academic performance. This aligns with the idea that students using AI tools frequently tend to perceive a clear connection between its use and improved outcomes in academics, and hence AI tools influence students' performance. These findings correspond with the theoretical assumption of technology-enhanced learning that more interaction with educational technologies, including AI tools, represents better learning outcomes (Tavakol & Dennick, 2011).

Discussion: This reveals that students see AI tools as indispensable means of increasing their learning process with the use of immediate feedback, streamlining their academic tasks and leaving more time for critical thinking and deep learning. This suggests that many students see the use of AI tools as strongly linked to academic success, and that no longer is AI just about being convenient, it is becoming a part of the academic strategy

for reaching the highest of academic milestones. This is in line with previous research (Luckin, et al., 2016) that showed that students who often leverage AI tools to fulfil duties like research, reach 'Writing, and High school exam preparation have observed notable accomplishments in educational results.

Key Findings
1. The study found that AI tools, such as ChatGPT, Grammarly, and Google Bard, have a positive effect on the academic performance of undergraduate students at AWKUM Garden Campus.
2. A substantial number of students reported improvements in their grades and overall academic performance due to the usage of AI tools, particularly in writing assignments, research work, and exam preparation.
3. The findings indicate a strong relationship between the frequency of AI tool usage and academic achievement. Students who used AI tools more frequently, particularly on a daily or weekly basis, demonstrated higher academic success.
4. Most of the students were of the view that AI tools also have an impact on their academic performance in a positive way. The respondents agreed that their grades had improved since they're using AI tools and more than half of them agreed with this.
5. However, results provide evidence that AI tools seem to have different levels of effectiveness based on students' academic achievement.

Recommendations
Based on the findings and theory the Social Cognitive Theory, several recommendations are made as to how AI tools can be used to better impact students' academic achievement.

Institutions should use AI tools to support students to have confidence in the use of AI tools, especially those having a low level of computer literacy. The SCT framework suggests that the increased students' belief in their capability to use these tools successfully can be achieved by offering tutorials and workshops. Based on this, use of AI tools should be generated within the learning environment way that encourages positive academic behavior. For example, using instant feedback provided by AI based tools such as grammar checkers or chat bots will act instant reinforcement to let them know when they are progressing. It promotes Peer Learning and Observational Learning: We have seen the importance of peer learning and this is one of the most important aspects of SCT. AI tools are being used in different ways by L2 learners across the world which institutions can enable them to share how they effectively use AI to improve their studies. It could create a supportive learning context, where in turn students can learn from other students' experiences and increase the strength of group self-efficacy regarding AI tools.

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