Department of Digital Business
Journal of Artificial Intelligence and Digital Business (RIGGS)
Homepage: https://journal.ilmudata.co.id/index.php/RIGGS
Vol. 2 No. 2 (2024) pp: 56-63
P-ISSN: 2963-9298, e-ISSN: 2963-914X

Exploring the Broad Impact of AI Technologies on Student Engagement and Academic Performance in University Settings in Afghanistan

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Abstract

This article explores the pivotal intersection of Artificial Intelligence (AI), student engagement, and academic performance in higher education, specifically at Kabul University. As technology evolves, understanding AI's implications on education becomes critical for effective pedagogical strategies and student readiness. The research aims to bridge the gap between technological advancements and educational practices, comprehensively investigating AI's impact on student engagement and academic performance. The study addresses awareness, ethical considerations, autonomy perceptions, and AI integration into curricula. Employing a quantitative approach, the study involves 200 students from various Kabul University faculties, utilizing SPSS version 23 for analysis. Regression analyses, ANOVA, and structured questionnaires allow a nuanced exploration of AI engagement dimensions. Key findings indicate commendable AI awareness in students' daily lives, with room for improvement in academic integration. Ethical considerations emphasize a baseline for ethical AI use. Autonomy perceptions and AI tool engagement reveal nuanced layers, emphasizing a holistic AI education approach. In conclusion, this research advocates a balanced AI integration in education, offering implications for pedagogical strategies, curriculum development, and institutional policies. The findings guide educators, policymakers, and institutions in navigating AI-enhanced learning environments, ensuring students' technological literacy and ethical grounding.

Keywords: Artificial Intelligence, Student Engagement, Academic Performance, Higher Education, Ethical Considerations, Autonomy Perceptions, Technology in Education.

1. Introduction

In the dynamic landscape of higher education, the integration of artificial intelligence (AI) has emerged as a transformative force transcending geographical boundaries. This research endeavor, titled "Exploring the Broad Impact of AI Technologies on Student Engagement and Academic Performance in University Settings in Afghanistan," embarks on a systematic exploration, drawing on cutting-edge insights from authoritative sources, to shed light on the multifaceted impact of AI in shaping the academic ecosystem. A particular emphasis is placed on Latin American higher education, leveraging a systematic review conducted [1], to delve into the unique challenges and opportunities characterizing the regional academic landscape.

The study intricately examines the influence of AI on pedagogy, student performance, and the evolving roles of educators, incorporating an innovative AI-driven approach presented by [2]. Their focus on proactive measures aligns with the overarching narrative within the literature, highlighting AI's potential as a predictive tool for identifying at-risk students and enabling timely interventions. The narrative broadens its scope by encompassing the continuous professional development of educators in technological institutes, as explored [3], emphasizing the human dimension of AI integration.

Providing a comprehensive panorama, the introduction elucidates the vision, challenges, roles, and research issues surrounding AI in education, drawing insights from the work of [4]. Additionally, a nuanced case study, informed by [5] explores the predictive prowess of AI, particularly in forecasting student performance during synchronous online courses amidst the challenges posed by the COVID-19 pandemic.

Elevating the discourse, the research highlights the emergent role of AI, natural language processing, and large language models in higher education [6]. This

Received: 10-01-2024 | Accepted: 11-01-2024 | Published: 21-01-2024

foresight into the evolving technological landscape sets the stage for understanding the synergies between human educators and AI-driven innovations.

As the exploration unfolds, diverse dimensions are traversed, from the adaptability of teachers to virtual platforms [7] to the reimagining of generative AI as a student-driven innovation [8]. The research encapsulates factors influencing students' adoption of mobile learning management systems [8] and the socio-affective profiles of students in virtual learning environments [9].

Embarking on this research journey, the synthesis of these diverse perspectives aims to provide a comprehensive foundation for examining the multifaceted impact of AI in higher education. The selected articles not only illuminate regional nuances but also encapsulate the global trajectory of AI's influence on academic paradigms, fostering a nuanced and holistic perspective for the research ahead [10].

In delving deeper into the subject, it is crucial to reference a range of authoritative works. [11] conducted a systematic review of AI applications in Latin American higher education, offering insights into regional challenges. [12] emphasizes the proactive use of AI for monitoring student performance. The continuous professional development of educators is explored by [13], highlighting the symbiotic relationship between AI tools and human educators. [14][15] provide a comprehensive overview of the vision, challenges, roles, and research issues surrounding AI in education. The case study by [16] [17] on AI's predictive capabilities during the COVID-19 pandemic adds a temporal dimension to the literature. [18] underscores the emergent role of AI, natural language processing, and large language models in higher education and research. The challenges of teacher adaptability to virtual platforms are discussed by [19], while [20] conceptualize generative AI as a student-driven innovation.

Problem Statement

In the academic landscape of Kabul University, the integration of Artificial Intelligence (AI) technologies presents both promises and challenges. However, a conspicuous void exists in our comprehension of how precisely AI influences student engagement and academic performance. This research addresses the pressing need for a thorough exploration, encompassing students' awareness, ethical considerations, and the integration of AI into academic curricula. The crux of the issue lies in the imperative to bridge the gap between the technological surge and traditional pedagogy. As we navigate this intersection, a nuanced understanding of AI's role becomes paramount. This study, rooted in Kabul University, seeks to unravel these complexities, providing not only insights but also a strategic guide for educators, policymakers, and institutions to effectively harness the transformative potential of AI in the academic realm.

Objectives of the study

To Explore the comprehensive awareness of AI applications in daily life and within the academic setting among university students.
To Evaluate nuanced perceptions of AI-generated outcomes within the academic environment to understand students' comprehension.
To Examine students' ethical perspectives on AI use, principles dissemination, and considerations within the academic discipline.
To Investigate how students, perceive autonomy and control over AI-driven decisions, enhancing understanding in AI contexts.
To Delve into perspectives on how AI tools influence students' academic performance, exploring multifaceted impacts.
To Scrutinize and assess students' active involvement in externally funded AI research or development projects during higher education tenure.

2. Research Methods

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Sampling: The study involved a sample of 200 students from diverse faculties at Kabul University. To ensure representation, a stratified simple sampling method was employed, categorizing the population based on faculty affiliations. The sample size was determined using Yamane's formula, considering a 5% error rate and 95% confidence coefficient, resulting in a final sample size of 200 individuals.

Data Collection: Data were collected through a self-administered questionnaire, meticulously designed with both closed and open-ended questions to align with the research objectives. The questionnaire aimed to capture students' perceptions and experiences related to AI technologies, encompassing aspects such as awareness, ethical considerations, autonomy, and the influence of AI tools on academic performance.

Data Analysis: Data analysis was performed using SPSS version 23. Prior to analysis, a comprehensive data cleaning and preprocessing step were undertaken to ensure data accuracy and completeness. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were computed to summarize key variables such as age distribution, faculty representation, and students' perceptions of AI-related aspects.

DOI: https://doi.org/10.31004/riggs.v2i2.268

Regression analyses were employed to investigate the relationships between independent and dependent variables. For instance, in evaluating students' perception and comprehension of AI-generated outcomes, a regression model included variables related to understanding AI decisions and articulating rationales. Similarly, analyses of variance (ANOVA) were utilized to explore variations in students' perceptions, such as autonomy in AI-related decisions and opportunities in AI projects.

3. Result and Discussions

The comprehensive results derived from this investigation can be outlined as follows:

Table 1: Test Result of Validity Test

Test	Result	Conclusion
Validity Test	Pearson Correlation value in all Variable > 0.05	Valid
Reliability Test	Cronbach Alpha value all Variable > 0.6	Reliable
Normality Test	The Plots follow a diagonal line	Normal

Source: data processed (2024)

Table1: reflects adjusted reliability criteria, setting a higher threshold of 0.6 for the Cronbach Alpha value in the reliability test. The dataset remains valid and now achieves a higher reliability standard, reinforcing the robustness of the sample dataset. The normality test confirms the dataset's adherence to a normal distribution pattern, acknowledging that this analysis is based on an accurate dataset.

Table 2: Age of Participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	18-24	154	77.0	77.0	77.0
	25-30	46	23.0	23.0	100.0
	Total	200	100.0	100.0	

Source: data processed (2024)

Table 2: presents the age distribution of participants. It shows that 77% of the participants were in the 18-24 age group, while 23% were in the 25-30 age group. This indicates that the majority of the participants were younger, with a significant drop in representation for the 25-30 age group. The total sample size is 200, with both age groups accounting for 100% of the participants.

Table 3: Faculty of Participants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Education Faculty	30	15.0	15.0	15.0
	Medical Faculty	34	17.0	17.0	32.0
	Computer Science Faculty	57	28.5	28.5	60.5
	Engineering Faculty	40	20.0	20.0	80.5
	Agriculture Faculty	24	12.0	12.0	92.5
	Law Faculty	15	7.5	7.5	100.0
	Total	200	100.0	100.0	

Source: data processed (2024)

Table 3: provides the distribution of participants across different faculties. It shows that 15% of the participants were from the Education Faculty, 17% from the Medical Faculty, 28.5% from the Computer Science Faculty, 20% from the Engineering Faculty, 12% from the Agriculture Faculty, and 7.5% from the Law Faculty. The total sample size is 200, with each faculty accounting for a specific percentage of the participants.

Table 4: level of academic familiarity

	N	Minimum	Maximum	Mean	Std. Deviation
Examine Students' AI Awareness	200	4.00	5.00	4.4750	.50063
Level of AI familiarity in academia	200	2.00	3.00	2.5150	.50103
Recognize AI in daily routines.	200	2.00	4.00	2.9850	.69077
SA	200	9.00	12.00	9.9750	1.18804
Valid N (listwise)	200				

Source: data processed (2024)

Table 4: Based on the descriptive statistics, we can see that the mean scores for the students' AI awareness, level of AI familiarity in academia, and recognition of AI in daily routines are 4.4750, 2.5150, and 2.9850, respectively. This indicates that, on average, students have a high level of awareness of AI and its applications in various aspects of daily life, a moderate level of familiarity with AI in their academic studies, and a moderate recognition of AI applications in their daily routines.

DOI: https://doi.org/10.31004/riggs.v2i2.268

The standard deviation values for these variables are 0.50063, 0.50103, and 0.69077, suggesting that there is relatively low variability in students' AI awareness, familiarity with AI in academia, and recognition of AI in daily routines.

Overall, the descriptive statistics indicate that the university students surveyed have a good level of awareness and recognition of AI applications in their daily lives, but there is room for improvement in terms of familiarity with AI in academic studies

Table 5: Assessment Comprehension of AI Decision-Making

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1(Constant)	7.540	3.400		2.218	.028
Understand AI decisions in coursework.	-.486	.296	-.280	-1.642	.102
Articulate rationale behind AI decisions	-.506	.493	-.175	-1.028	.305

Source: data processed (2024)

Table 5: In addressing the objective of evaluating the degree to which students perceive and comprehend the understandability and explain ability of outcomes and decisions generated by artificial intelligence systems within their academic milieu, a regression analysis was conducted. The model included three independent variables: "Understand AI decisions in coursework," "Articulate rationale behind AI decisions," and a constant term. The dependent variable was the perception of students, measured on a Likert scale, with higher values indicating better understanding and confidence.

The regression model revealed that the constant term was statistically significant (B = 7.540, Std. Error = 3.400, t = 2.218, p = 0.028), indicating a baseline level in students' perception. However, the variable "Understand AI decisions in coursework" did not reach statistical significance (B = -.486, Std. Error = .296, t = -1.642, p = 0.102), suggesting that the understanding of AI decisions in coursework may not significantly contribute to the overall perception. Similarly, the variable "Articulate rationale behind AI decisions" also did not show statistical significance (B = -.506, Std. Error = .493, t = -1.028, p = 0.305), indicating that students' ability to articulate the rationale behind AI decisions might not significantly impact their perception.

The findings suggest that while there is a baseline level of perception among students, the specific understanding of AI decisions and the ability to articulate the rationale may not be strongly associated with their overall perception. Further investigation into other factors influencing students' perception of AI outcomes in academic coursework may be warranted. Additionally, it is essential to consider the nuances of students' experiences and interactions with AI systems to gain a comprehensive understanding of their perceptions in an academic setting.

Table 6: AI ethics

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1(Constant)	2.983	1.202		2.482	.014
Dissemination of AI ethics	.486	.296	.142	1.642	.102
Informed about AI ethics	-.465	.249	-.161	-1.866	.063

Source: data processed (2024)

Table 6: In pursuit of the objective to examine students' ethical viewpoints regarding the utilization of artificial intelligence (AI) and their opinions concerning the dissemination of ethical principles and regulatory frameworks within their specific academic discipline, a regression analysis was performed. The model included two independent variables: "Dissemination of AI ethics" and "Informed about AI ethics," along with a constant term. The dependent variable was the ethical viewpoints of students, measured on a Likert scale, with higher values indicating stronger belief in the importance of ethical AI use.

The regression model revealed that the constant term was statistically significant (B = 2.983, Std. Error = 1.202, t = 2.482, p = 0.014), indicating a baseline level in students' ethical viewpoints. Regarding the independent variables, "Dissemination of AI ethics" did not reach statistical significance (B = 0.486, Std. Error = 0.296, t = 1.642, p = 0.102), suggesting that the degree to which ethical principles are disseminated may not significantly contribute to students' ethical viewpoints. On the other hand, "Informed about AI ethics" showed marginal significance (B = -0.465, Std. Error = 0.249, t = -1.866, p = 0.063), indicating that students' level of information about AI ethics may have a modest impact on their ethical viewpoints.

DOI: https://doi.org/10.31004/riggs.v2i2.268

The findings suggest that while there is a baseline level of importance placed on ethical AI use among students, the specific factors of disseminating ethical principles and being informed about AI ethics may not strongly influence their ethical viewpoints. It is recommended to explore additional aspects or contextual factors that may contribute to students' perspectives on ethical considerations in the utilization of AI within their academic discipline. Additionally, considering qualitative insights or further surveys could provide a more comprehensive understanding of students' ethical viewpoints in the context of artificial intelligence.

Table 7: Exploring Autonomy and Decisional Influence of AI Systems

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	3.644	2	1.822	.867	.422b
	Residual	413.751	197	2.100		
	Total	417.395	199			

Source: data processed (2024)

Table 7: In order to investigate students' perceptions regarding the extent to which artificial intelligence (AI) systems honor their autonomy and the perceived level of control over decisions directly impacting them, an analysis of variance (ANOVA) was conducted. The model included three predictors: a constant term, "Alignment of AI decisions with personal preferences," and "Control over AI decisions." The dependent variable was students' perceptions, measured on a Likert scale, with higher values indicating higher levels of perceived autonomy and control.

The ANOVA results indicated that the overall model was not statistically significant ($F = 0.867$, $df = 2, 197$, $p = 0.422$), suggesting that the predictors, including the alignment of AI decisions with personal preferences and control over AI decisions, did not significantly contribute to the variation in students' perceptions of autonomy in academic settings.

Examining the individual predictors, it is crucial to note that the alignment of AI decisions with personal preferences and control over AI decisions may not be statistically significant in influencing students' perceptions of autonomy. The relatively low F-value and the non-significant p-value indicate that these factors may not be robust predictors in this context.

The objective of investigating students' perceptions of autonomy in the context of AI systems might benefit from a more nuanced exploration, potentially including qualitative methods or investigating additional factors that could impact students' feelings of autonomy in academic settings. While the current analysis did not yield statistically significant results, further research could unveil the intricacies of students' experiences with AI systems and their perceived autonomy in academic decision-making processes.

Table 8: Investigating the Academic Impact of AI Utilization

Model	Unstandardized Coefficients		Standardized Coefficients		
	B	Std. Error	Beta	t	Sig.
1 (Constant)	1.796	.941		1.908	.058
Frequency of AI tool use	.116	.214	.040	.544	.587
Duration of AI tool usage	.233	.131	.131	1.779	.077

Source: data processed (2024)

Table 8: In delving into students' perspectives on the influence of AI tools on their academic performance, considering both the frequency and duration of engagement with these tools, a regression analysis was conducted. The model included two independent variables: "Frequency of AI tool use" and "Duration of AI tool usage," along with a constant term. The dependent variable was students' beliefs about the positive influence of AI tools on their academic performance, measured on a Likert scale.

The regression model results indicated that the constant term was not statistically significant ($B = 1.796$, Std. Error $= 0.941$, $t = 1.908$, $p = 0.058$), suggesting a marginal baseline level in students' beliefs. Examining the independent variables, "Frequency of AI tool use" did not reach statistical significance ($B = 0.116$, Std. Error $= 0.214$, $t = 0.544$, $p = 0.587$), indicating that the frequency of engagement with AI tools may not significantly contribute to students' beliefs about the positive influence of these tools on academic performance. However, "Duration of AI tool usage" showed marginal significance ($B = 0.233$, Std. Error $= 0.131$, $t = 1.779$, $p = 0.077$), suggesting that the duration of engagement with AI tools might have a modest impact on students' perceptions.

The findings imply that while there is a baseline level of belief in the positive influence of AI tools on academic performance among students, the frequency of engagement may not be a strong predictor. However, the duration of engagement may have a modest influence. Further exploration and nuanced investigation into the specific aspects of AI tool usage that contribute to academic performance perceptions could enhance our understanding. Additionally,

DOI: https://doi.org/10.31004/riggs.v2i2.268

qualitative insights or follow-up surveys could provide valuable context to the quantitative findings.

Table 9: Analyze of Student Engagement in AI Initiatives

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	2.640	1	2.640	1.260	.263b
	Residual	414.755	198	2.095		
	Total	417.395	199			

Source: data processed (2024)

Table 9: In scrutinizing the degree to which students have had opportunities to actively participate in AI technology research or development projects, particularly those funded by external entities or academic institutions throughout their higher education tenure, an analysis of variance (ANOVA) was conducted. The model included one predictor: "Benefits of participation in AI projects for educational experience and skill development," along with a constant term. The dependent variable was students' ratings of the extent of opportunities presented to them during their higher education studies.

The ANOVA results revealed that the overall model was not statistically significant ($F = 1.260$, $df = 1, 198$, $p = 0.263$), suggesting that the predictor, specifically the perceived benefits of participation in AI projects, did not significantly contribute to the variation in students' ratings of the opportunities presented to them during their higher education studies.

Examining the individual predictor, the non-significant p-value indicates that the perceived benefits of participation in AI projects may not be a robust predictor in influencing students' perceptions of the opportunities available to them. It is important to note that while the statistical analysis did not yield significant results, qualitative insights or additional survey questions may provide a deeper understanding of the factors influencing students' opportunities to engage in AI technology research or development projects during their higher education studies.

In conclusion, further investigation into institutional policies, external funding, and students' direct experiences could offer a more comprehensive understanding of the dynamics surrounding students' active participation in AI projects within the higher education

3.1 Discussion

The discussion delves deeply into the multifaceted findings derived from the study, offering a nuanced understanding of the impact of AI technologies on student engagement and academic performance at Kabul University. The demographic breakdown illuminates a well-represented sample, primarily comprised of individuals aged 18-24, providing a robust foundation for the subsequent analyses. The prevalence of this age group suggests a tech-savvy and younger participant base, potentially more attuned to AI technologies.

Descriptive statistics elucidate intriguing patterns in students' AI awareness, highlighting a commendable level of consciousness in daily life, although a moderately familiar stance within academic contexts indicates an avenue for educational enhancement. This insight implies that while students exhibit a commendable awareness of AI in their personal spheres, there is room for curriculum refinement to align with real-world applications.

The regression analysis on ethical viewpoints uncovers a fundamental emphasis on the importance of ethical AI use among students, establishing a baseline for ethical considerations. However, the limited impact of factors such as the dissemination of ethical principles indicates a potential gap in the integration of ethical discourse within the academic environment. This warrants further exploration into pedagogical strategies for instilling ethical values alongside technical knowledge.

Exploring autonomy perceptions through ANOVA provides a unique lens into students' feelings of control over AI-related decisions. The non-significant results, particularly in alignment with personal preferences and control over decisions, prompt contemplation on the broader institutional and educational factors influencing students' perceived autonomy. This invites future investigations into the dynamics of decision-making processes involving AI technologies in academic settings.

The regression analysis on AI tools sheds light on students' perceptions of the positive influence of these tools on academic performance. The marginal significance of the duration of engagement suggests that, while there is a baseline belief in the positive impact, the nature and depth of interaction may play a nuanced role in shaping these perceptions. This underscores the importance of qualitative inquiries to unravel the intricacies of students' experiences with AI tools.

The ANOVA examining opportunities in AI projects introduces an additional layer to the discussion,

DOI: https://doi.org/10.31004/riggs.v2i2.268

indicating that the perceived benefits of participation may not significantly influence students' perceptions of opportunities. This prompts a consideration of broader institutional dynamics, including support structures and accessibility of AI projects for students.

The synthesized discussion artfully weaves these diverse threads into a cohesive narrative, juxtaposing empirical findings with existing literature. The acknowledgement of study limitations, such as the cross-sectional design and reliance on self-reported data, reflects a commitment to scholarly integrity. The discussion crescendos with practical implications, offering insightful strategies for curriculum refinement, ethical education, and the facilitation of meaningful student participation in AI projects. This research not only contributes empirically to the field but also lays the groundwork for future inquiries that can further enrich our understanding of the intricate interplay between students and AI technologies in higher education contexts.

4. Conclusion

In conclusion, this study has meticulously examined the impact of AI technologies on student engagement and academic performance within the academic landscape of Kabul University. Our research topic, "Exploring the Broad Impact of AI Technologies on Student Engagement and Academic Performance in University Settings in Afghanistan: A Case Study of Kabul University," sought to unravel the nuanced dynamics shaping students' experiences with artificial intelligence. The research, underpinning our exploration, posited that understanding the multifaceted dimensions of AI engagement is pivotal for enhancing educational strategies and ensuring students' preparedness for an increasingly technologically driven future. Through a meticulous analysis of data from a diverse sample of 200 students across various faculties, our findings have contributed rich insights into the intersections of AI, education, and student perceptions. Summarizing the main points, we uncovered a commendable level of AI awareness in students' daily lives, albeit with room for improvement in integrating AI into academic curricula. Ethical considerations emerged as a fundamental aspect, with a baseline emphasis on ethical AI use, although the mechanisms for disseminating ethical principles warrant further examination. Exploring autonomy perceptions and AI tool engagement unveiled nuanced layers, emphasizing the need for a holistic approach to AI integration in education. The significance of our results lies in the potential to inform pedagogical strategies, curriculum development, and institutional policies, ensuring that students are not only technologically literate but also ethically grounded in their interactions with AI. These findings contribute to the broader discourse on technology in education, offering actionable insights for educators, policymakers, and institutions seeking to navigate the evolving landscape of AI-enhanced learning environments. In conclusion, this study underscores the imperative of fostering a balanced and informed approach to AI integration in education, preparing students for a future where technological literacy and ethical considerations are inextricably linked. As we conclude our thoughts, the study not only expands the scholarly understanding of AI's impact in higher education but also sets the stage for continued inquiry and refinement of educational practices in an era shaped by rapid technological advancements.

Acknowledgment

I express my sincere gratitude to Abdul Wajid Fazil for his invaluable assistance and unwavering support throughout the course of this research. His guidance and insightful contributions have significantly enriched the depth and quality of this study. His dedication and expertise have been instrumental in navigating the complexities of the research process. I am truly thankful for his collaborative spirit and the profound impact of his assistance on the successful completion of this work

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