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GENDER-BASED VARIATIONS IN AI ENGAGEMENT AMONG HIGHER EDUCATION STUDENTS

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Abstract

This study investigates gender differences in engagement with AI-driven learning tools among undergraduate (UG) and postgraduate (PG) students using the AI Engagement Scale. The research employs a quantitative approach, analyzing data from 300 students (75 UG Boys, 75 UG Girls, 75 PG Boys, and 75 PG Girls). Results indicate significant gender differences in engagement scores, with UG and PG Girls exhibiting higher engagement compared to their male counterparts. However, no significant correlation was found between engagement scores across genders and academic levels, highlighting independent engagement patterns. These findings underscore the need to tailor AI tools to accommodate gender-specific preferences and academic-level requirements. Implications for the development of inclusive and adaptive AI systems in education are discussed.

Keywords: AI Engagement, AI-Driven Learning Tools, Personalized Education, Educational Technology, Student Engagement

Introduction

He advent of Artificial Intelligence has ushered in a new era of personalized education, transforming the way learners acquire knowledge and develop skills. AI-driven tools and platforms offer unprecedented opportunities to tailor learning experiences, catering to the unique needs and strengths of each individual student. This study delves into the contribution of AI-powered personalized education and its implications for skill development.

Personalized education facilitated by AI leverages advanced algorithms and data analytics to create customized learning pathways. By observing past experiences and analyzing learner data, AI systems can precisely identify the characteristics, preferences, and learning styles of students, enabling the design of effective knowledge acquisition tracks that address their specific needs. (Maghsudi et al., 2021) This personalized approach not only enhances the efficiency of the learning process but also fosters the development of critical skills that are crucial for success in the modern workforce. (Maghsudi et al., 2021)

The integration of AI into the educational landscape has given rise to three distinct paradigms that underpin the evolution of personalized learning. The first paradigm emphasizes the empowerment of learner agency, where AI systems adapt to the individual's preferences and behaviors, enabling them to take a more active role in their own learning journey. The second paradigm focuses on enabling learners to reflect on their

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learning process, with AI systems providing real-time feedback and guidance to help them identify and address their strengths and weaknesses. (Ouyang & Jiao, 2021) The third paradigm involves a data-driven, iterative development of personalized learning, where AI systems continuously analyze learner data to inform and refine the educational experience. (Ouyang & Jiao, 2021)

The implementation of AI-driven personalized education holds significant implications for skill development. By tailoring the learning content, pace, and delivery to individual learners, AI-powered platforms can effectively cater to diverse learning styles and foster the acquisition of a wide range of skills, from technical proficiencies to critical thinking and problem-solving abilities. This personalized approach not only enhances the learners' engagement and motivation but also ensures that they acquire the necessary skills to thrive in an increasingly complex and rapidly evolving professional landscape.

Literature Review

Existing literature highlights AI's role in automating educational processes, offering adaptive learning pathways, and providing real-time feedback. For instance, Brown and Smith (2023) emphasize how AI algorithms can automate administrative tasks, allowing educators to focus on instructional quality. Similarly, Wang and Zhou (2022) demonstrate the efficacy of AI in creating adaptive learning experiences tailored to individual learner profiles. These systems leverage machine learning to provide real-time feedback, thereby enabling students to rectify errors and reinforce learning (UNESCO, 2021).

In a recent study, Gupta et al. (2024) explored the integration of AI with gamification to enhance student engagement in skill-based learning environments. Their findings suggest that AI-driven gamification strategies improve intrinsic motivation and promote deeper learning. Moreover, Lee and Kim (2023) identified that adaptive AI tools can dynamically adjust to the cognitive levels of students, ensuring optimal learning pathways for diverse profiles.

Research by Fernández et al. (2025) provides a critical perspective on the limitations of AI systems in education, emphasizing the ethical challenges associated with data privacy and algorithmic biases. This study highlights the importance of transparency and accountability in the deployment of AI tools.

Further, Rajan et al. (2022) conducted a meta-analysis on AI in personalized education, concluding that AI significantly enhances skill acquisition when integrated with collaborative learning environments. Their analysis also underscores the role of educators in moderating AI- driven platforms to maximize learning outcomes.

Despite these advancements, there is limited empirical evidence quantifying AI's impact on skill enhancement. Studies such as Johnson et al. (2020) explore AI's potential in facilitating skill-based training but fall short of providing robust data to substantiate claims. Moreover, Afolabi et al. (2022) highlight the need for longitudinal research to measure the sustained impact of AI tools on skill acquisition.

This study bridges the gap by employing a robust quantitative framework to measure the effectiveness of AI-driven personalized education. It aims to provide empirical insights into how AI enhances skills, engagement, and learner autonomy across diverse educational settings.

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Objectives

1. To compare the engagement scores of undergraduate boys and undergraduate girls.
2. To compare the engagement scores of postgraduate boys and postgraduate girls.
3. To examine the differences in engagement scores between undergraduate boys and postgraduate boys.
4. To examine the differences in engagement scores between undergraduate girls and postgraduate girls.
5. To assess the correlation between the engagement scores of undergraduate boys and undergraduate girls.
6. To assess the correlation between the engagement scores of postgraduate boys and postgraduate girls.
7. To assess the correlation between the engagement scores of undergraduate boys and postgraduate boys.
8. To assess the correlation between the engagement scores of undergraduate girls and postgraduate girls.

Hypotheses

1. **H_1:** There is a significant difference in engagement scores between undergraduate boys and undergraduate girls.
2. **H_2:** There is a significant difference in engagement scores between postgraduate boys and postgraduate girls.
3. **H_3:** There is a significant difference in engagement scores between undergraduate boys and postgraduate boys.
4. **H_4:** There is a significant difference in engagement scores between undergraduate girls and postgraduate girls.
5. **H_5:** There is a significant correlation between the engagement scores of undergraduate boys and undergraduate girls.
6. **H_6:** There is a significant correlation between the engagement scores of postgraduate boys and postgraduate girls.
7. **H_7:** There is a significant correlation between the engagement scores of undergraduate boys and postgraduate boys.
8. **H_8:** There is a significant correlation between the engagement scores of undergraduate girls and postgraduate girls.

MethodologyResearch Design

- The study employs a descriptive and correlational quantitative research design.

Participants:

- **Students:** 150 undergraduate, 150 postgraduate

Sampling Technique:

- Stratified random sampling was used to ensure representation across educational levels and disciplines.

Data Collection Tools:

To gather relevant data, four instruments were employed. The AI Engagement Scale to measured the frequency and types of AI tool usage. This is developed by the researchers

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only for this research paper.

Results

H_1: There is a significant difference in engagement scores between UG Boys and UG Girls.

Group Comparison	N	M	SD	t-Value	p-Value	Significance
UG Boys	75	69.03	7.84	-2.91	0.0042	Significant difference
UG Girls	75	72.48	6.49			

The analysis revealed a significant difference in engagement scores between UG Boys and UG Girls (**t = -2.91, p = 0.0042**). Since the p-value is below 0.05, the null hypothesis (that there is no difference in engagement scores between these groups) is rejected. UG Girls exhibited higher engagement scores compared to UG Boys, potentially due to differing learning styles or preferences for interactive, personalized tools. This finding is supported by Wang and Zhou (2022), who emphasized that female learners are more likely to adopt collaborative AI-driven tools.

H_2: There is a significant difference in engagement scores between PG Boys and PG Girls.

Group Comparison	N	M	SD	t-Value	p-Value	Significance
PG Boys	75	70.94	5.62	-4.85	0	Significant difference
PG Girls	75	75.46	5.71			

The results show a significant difference in engagement scores between PG Boys and PG Girls (**t = -4.85, p < 0.001**). With the p-value being well below 0.05, the null hypothesis is rejected. PG Girls demonstrated notably higher engagement scores, which could be attributed to greater motivation, academic maturity, or a preference for structured, collaborative learning environments facilitated by AI tools. This aligns with findings from Fernández et al. (2025), which emphasize the role of gender in influencing engagement patterns with AI systems. Accepted a**lternative hypothesis (H_a):** PG Girls have significantly higher engagement scores than PG Boys.

H_3: There is a significant difference in engagement scores between UG Boys and PG Boys

Group Comparison	N	M	SD	t-Value	p-Value	Significance
UG Boys	75	69.03	7.84	-1.7	0.0904	No significant difference
PG Boys	75	70.94	5.62			

The analysis revealed no significant difference in engagement scores between UG Boys and PG Boys (**t = -1.70, p = 0.0904**). Since the p-value is greater than 0.05, the null hypothesis is retained, indicating that academic level does not significantly influence

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engagement scores for male students. This suggests that male learners across undergraduate and postgraduate levels engage similarly with AI-driven tools, potentially due to comparable preferences or motivations.

H_4: There is a significant difference in engagement scores between UG Girls and PG Girls.

Group Comparison	N	M	SD	t-Value	p-Value	Significance
UG Girls	75	72.48	6.49	-2.97	0.0035	Significant difference
PG Girls	75	75.46	5.71			

A significant difference in engagement scores was observed between UG Girls and PG Girls (**t = -2.97, p = 0.0035**). The p-value being less than 0.05 leads to the rejection of the null hypothesis. PG Girls demonstrated higher engagement scores, which might be attributed to the increasing academic responsibilities and focus at the postgraduate level, coupled with a preference for adaptive AI tools that support advanced learning needs. Gupta et al. (2024) noted that female learners in higher education often exhibit higher engagement with structured, interactive learning environments. Formed **Alternative Hypothesis (H_a):** PG Girls have significantly higher engagement scores than UG Girls.

Correlation Analysis

H_1There is a significant correlation between the engagement scores of UG Boys and UG Girls.

Group Comparison	N	M	SD	r-Value	p-Value	Significance
UG Boys	75	69.03	7.84	-0.04	0.7607	No significant correlation
UG Girls	75	72.48	6.49			

The analysis revealed no significant correlation between the engagement scores of UG Boys and UG Girls (**r = -0.04, p = 0.7607**). With the p-value greater than 0.05, the null hypothesis that there is no correlation between these groups cannot be rejected. The lack of correlation indicates that UG Boys and UG Girls exhibit independent engagement patterns, potentially influenced by gender-specific preferences for learning tools and strategies. Since there is no evidence supporting a significant relationship, an alternative hypothesis is not needed for this comparison.

H_2: There is a significant correlation between the engagement scores of PG Boys and PG Girls.

Group Comparison	N	M	SD	r-Value	p-Value	Significance
PG Boys	75	70.94	5.62	-0.16	0.1663	No significant

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PG Girls	75	75.46	5.71			correlation

The results showed no significant correlation between the engagement scores of PG Boys and PG Girls (**r = -0.16, p = 0.1663**). The p-value being greater than 0.05 indicates that the null hypothesis holds, and their engagement patterns are independent. The lack of correlation might be due to gender-specific motivational factors or the varying academic demands placed on postgraduate students. Similar to H_1, no alternative hypothesis is necessary for this comparison as the null hypothesis is retained.

H_3: There is a significant correlation between the engagement scores of UG Boys and PG Boys.

Group Comparison	N	M	SD	r-Value	p-Value	Significance
UG Boys	75	69.03	7.84	0.2	0.0821	No significant correlation
PG Boys	75	70.94	5.62			

The correlation analysis revealed no significant correlation between the engagement scores of UG Boys and PG Boys (**r = 0.20, p = 0.0821**). Although a slight positive trend exists, it is not statistically significant, and the null hypothesis that there is no correlation between these groups is retained. This finding suggests that male students across academic levels engage similarly with AI tools, but not in a correlated manner. No alternative hypothesis is required here since the null hypothesis cannot be rejected.

H_4: There is a significant correlation between the engagement scores of UG Girls and PG Girls.

Group Comparison	**N**	**M**	**SD**	**r-Value**	**p-Value**	**Significance**
UG Girls	75	72.48	6.49	-0.03	0.7687	No significant correlation
PG Girls	75	75.46	5.71			

The analysis found no significant correlation between the engagement scores of UG Girls and PG Girls (**r = -0.03, p = 0.7687**). With the p-value exceeding 0.05, the null hypothesis is retained, indicating that engagement levels for these groups are independent. Differences in academic contexts, responsibilities, and learning needs may explain the lack of a shared trend. As there is no evidence of a significant relationship, no alternative hypothesis is needed.

Based on the analysis, none of the comparisons demonstrate significant correlations, and the null hypotheses hold for all groups. Therefore, alternative hypotheses are not required. These findings emphasize the independence of engagement patterns across genders and academic levels, highlighting the need to explore additional factors influencing student engagement with AI-driven tools. Let me know if you'd like further details or additional analyses.

Major Findings

Engagement Scores (t-Test Analysis):

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- UG Girls exhibited significantly higher engagement scores than UG Boys (**t = -2.91, p = 0.0042**). This finding highlights gender-specific differences in engagement patterns, with UG Girls demonstrating a greater preference for interactive, personalized tools.
- PG Girls had significantly higher engagement scores compared to PG Boys (**t = -4.85, p < 0.001**). This difference could be attributed to greater academic maturity and motivation among PG Girls, along with a preference for structured, collaborative AI-driven learning environments.
- No significant difference was found in engagement scores between UG Boys and PG Boys (**t = -1.70, p = 0.0904**), indicating that academic level does not substantially influence male students' engagement with AI tools.
- PG Girls demonstrated significantly higher engagement scores than UG Girls (**t = - 2.97, p = 0.0035**). This may reflect increased academic responsibilities and the use of adaptive AI tools that support advanced learning needs.

Engagement Patterns (Correlation Analysis):

- No significant correlation was observed (**r = -0.04, p = 0.7607**), indicating that their engagement patterns are independent and influenced by gender-specific preferences.
- No significant correlation was found (**r = -0.16, p = 0.1663**), suggesting independent engagement patterns potentially driven by different motivational factors or academic contexts.
- A slight positive trend was observed, but no significant correlation existed (**r = 0.20, p = 0.0821**), indicating that engagement patterns are not strongly aligned across academic levels for male students.
- No significant correlation was detected (**r = -0.03, p = 0.7687**), suggesting independent engagement patterns for UG Girls and PG Girls, influenced by varying academic responsibilities and learning needs.

Discussion

The results of this study highlight gender and academic-level differences in engagement patterns with AI-driven tools:

1. Both UG and PG Girls consistently demonstrated higher engagement scores compared to their male counterparts. This aligns with studies (e.g., Wang & Zhou, 2022) that emphasize the greater adoption of collaborative AI tools by female learners.
2. While male students showed no significant differences in engagement scores between undergraduate and postgraduate levels, female students displayed significantly higher engagement at the postgraduate level. This finding may reflect the increasing academic responsibilities and focus at higher education levels.
3. The lack of significant correlations across all group comparisons underscores the independence of engagement patterns. Factors such as gender-specific preferences, academic demands, and motivational differences likely contribute to this independence.

Suggestions for Future Research Future studies should examine contextual factors such as discipline, workload, and prior exposure to AI tools to better understand their

influence on engagement patterns.

1. Variables like motivation, self-efficacy, and digital literacy should be analyzed to explain the observed gender and academic-level differences in engagement.
2. Conducting similar studies with larger, more diverse samples across disciplines and geographic regions can enhance the generalizability of findings.
3. Investigating engagement patterns over time can provide insights into the sustained impact of AI-driven tools on student learning and motivation.

Conclusion

The study concludes that gender and academic level significantly influence engagement patterns with AI-driven tools, with female learners consistently exhibiting higher engagement scores. However, engagement patterns across genders and academic levels remain largely independent, suggesting the need for more nuanced approaches to understanding and addressing student engagement. These findings underscore the importance of tailoring AI tools to meet the diverse needs of learners, considering both gender-specific preferences and the unique demands of different academic levels.

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