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AI's Promise and Peril: Evaluating the SHAPE Framework on Academic Commitment and Gender Outcomes in Higher Education

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Abstract **-** This study investigates the implementation of the SHAPE framework in undergraduate business courses at Tecnologico de Monterrey, assessing its impact on enhancing learning, preference for AI use, academic commitment, and development of reflection and research skills with Artificial Intelligence (AI) tools. A mixed-method approach was employed, replicating and expanding upon a previous study using a larger and more diverse sample involving 90 students in the fifth semester of International Business across two campuses. Data collection included quantitative surveys, student reflections, and course deliverable analysis. Results confirmed the overall positive perception of AI's benefits but revealed significant gender disparities. Women exhibited higher acceptance and engagement with AI, especially concerning reflective and research skills, while men favored AI for practical problem-solving. The findings of this study are consistent with existing literature on gender and technology adoption and underscore the necessity of inclusive pedagogical strategies that leverage AI's potential while accommodating diverse learning styles and preferences. The research highlights the importance of considering gender-specific needs when designing and implementing AI-integrated educational technologies. Limitations include a restricted sample to one-degree program across two campuses and the cross-sectional design prevents an evaluation of the long-term effects. Future research should examine the model's long-term impact, comparative effectiveness, and broader applicability across diverse educational contexts.

Keywords**:** Higher education, Artificial Intelligence, SHAPE framework, Critical thinking, Educational innovation, Professional Education, Gender differences.

1. Introduction

The incorporation of Artificial Intelligence (AI) in higher education is transforming learning methodologies by offering tools that can personalize and enrich the educational experience. When used ethically and responsibly, AI can automate repetitive tasks, freeing up time for students to focus on developing higher-order skills such as critical thinking, creativity, and in-depth analysis [1]. However, the impact of AI on the development of these skills remains a subject of debate and analysis, as its misuse could lead to excessive dependence on technology and hinder students' cognitive autonomy [2].

In this context, Rodríguez [3] developed a methodological framework called SHAPE, designed to integrate AI into the process of creating academic texts through a co-creation approach. This framework proposes a series of steps guiding students in using AI assistants to improve the quality and originality of their academic work, complementing rather than replacing traditional education. This study aims to replicate and validate Rodríguez's framework, evaluating its effectiveness on a larger and more diverse sample to determine the extent to which this methodology enhances learning and creative development among students.

This research also explores the influence of gender on the adoption and perception of AI in educational contexts. Previous studies have indicated that gender differences can influence technology adoption, with men and women tending to value different aspects, such as ease of use and practical functionality [4,5]. Analyzing these differences in the context of AI for academic co-creation will provide valuable insights into how to personalize and optimize the use of these tools for different student groups.

Finally, this study contributes to the existing literature on AI in higher education by addressing an important gap related to the responsible and personalized use of these technologies. By replicating Rodríguez's framework with a focus on additional variables such as gender, the study aims to offer a broader perspective on AI's potential to foster critical thinking and creativity among university students, contributing to the discussion on the inclusive and effective adoption of emerging technologies in education.

2. Theoretical Framework

2.1. AI in Higher Education

AI has generated increasing interest in higher education due to its capacity to personalize learning and support the development of critical skills such as analytical thinking and problem-solving [6,7]. These technologies provide real-time feedback and allow for content adaptation to individual student needs. However, some authors have expressed concerns about the possibility of excessive AI use reducing human interaction and negatively affecting students' socio-emotional development [8].

2.2. Quality Criteria in Academic Work

There are different attributes that allow evaluating the quality of the products delivered by the students. Among the most relevant are the originality, coherence, relevance, precision, and depth of the content [9].

Originality refers to the work's ability to contribute novel ideas, approaches, or information to the field of study. Coherence evaluates the logic and organization of ideas. Relevance considers the pertinence of the work and its timeliness. Precision implies the accuracy of the data and its correct interpretation. Depth refers to the level of analysis and research conducted [10].

AI-based virtual assistants could enhance quality by helping to express ideas clearly and concisely, correcting errors, and strengthening arguments [11]. Similarly, web and mobile tools allow for generating original content for academic work [12].

However, it is important to note that the use of these tools must be informed, ethical, and responsible [12]. This implies that students must understand the role of AI tools as support for their own intellectual work and not as a replacement for it.

2.3. Technology Adoption Models

The first theoretical advancements explaining the underlying factors of technology adoption were provided by Everett Rogers in 1962 with his Diffusion of Innovations theory. This theory focuses on explaining how new technologies spread within a population. Rogers proposed that adoption occurs in stages, beginning with awareness of the innovation, followed by persuasion, decision, implementation, and finally, confirmation. His main contribution lies in the analysis of social and communicative factors in the technology adoption process—an approach that remains a key reference in current studies.

In 1989, Fred Davis developed the Technology Acceptance Model (TAM), which became a fundamental framework for understanding the factors influencing individual technology adoption. The TAM proposes that an individual's perception of a technology's usefulness, along with its perceived ease of use, determines their intention to adopt it. This theoretical simplification allowed the TAM to be widely used in empirical research and applied to various technological contexts, including information systems and digital tools in education [13]. The TAM's focus on individual users and their personal perceptions contrasts with the population-level perspective of Rogers' theory, marking a shift toward understanding the psychological factors in technology adoption.

A theory that complements the TAM is Ajzen's Theory of Planned Behavior (TPB) [14], which expands the understanding of technology adoption by including additional psychological and social factors. According to the TPB, an individual's behavior is influenced by three main components: their attitude toward using the technology, subjective norms (i.e., perceived social pressure), and perceived behavioral control, which refers to the perceived ease or difficulty of performing an action. These factors determine the intention to adopt a technology, and this intention translates into the actual probability of use [14].

In the context of higher education, the TPB is particularly relevant because it allows for the analysis of how individual perceptions and social influences affect the adoption of technological innovations, such as artificial intelligence. By

considering both internal factors (attitudes and perceived control) and external factors (social norms), the TPB offers a more comprehensive approach to understanding the adoption of educational technologies. This facilitates the identification of key barriers and motivators, contributing to the development of effective strategies for promoting the use of advanced technological tools in educational settings [15, 16].

At the beginning of the 2000s, Venkatesh et al. proposed a significant extension of previous models with the Unified Theory of Acceptance and Use of Technology (UTAUT). This model, developed in 2003, unified elements of the TAM, the Theory of Planned Behavior [14], and Rogers' Diffusion of Innovations theory. UTAUT incorporates four main constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions; it also introduces moderators such as gender, age, and experience to better explain variations in technology adoption [16]. This model allowed for a more holistic view of technology adoption, encompassing not only individual factors but also organizational and social factors, providing a solid foundation for research in broader areas such as business and education.

Other authors, such as Legris, Ingham, and Collerette [17], offered a constructive critique of the TAM. In their review, they argued that while the TAM is useful for explaining some aspects of technology adoption, it is insufficient to capture the contextual and organizational complexities that influence this process. They proposed the inclusion of more situational and organizational variables to improve the model's explanatory power, highlighting the need for more integrative approaches that consider both personal and environmental factors. This critical review spurred new lines of research that sought to expand existing models to make them more inclusive.

In conclusion, the evolution of technology adoption models has shifted from sociological approaches focused on the diffusion of innovations at the population level to psychological and organizational models that focus on individual perceptions and contextual factors. While Rogers laid the groundwork with his focus on the diffusion of innovations, Davis and Venkatesh provided more individually-centered models, gradually expanding their scope to include social and contextual factors. These models have been fundamental in developing a comprehensive understanding of the technology adoption process, and they are widely used in contemporary research and practice.

2.4. Gender Differences in Technology Adoption

Gender has been identified as a key factor influencing technology adoption. According to Venkatesh and Morris [4], men are more influenced by the perceived usefulness of technology, while women place greater importance on ease of use and social influences. In the context of AI, research suggests that women may be more receptive to technologies that facilitate collaboration and active learning, whereas men may prefer tools that optimize specific tasks [5]

This study draws upon the Technology Acceptance Model (TAM) [13] and Bandura's Social Learning Theory [18], which posits that self-efficacy plays a fundamental role in engagement with technological activities. These theories provide a framework for understanding how gender differences influence the adoption and perception of AI in educational settings.

3. Methodology

3.1. Design

This study employed a mixed approach [19], combining quantitative and qualitative methods to obtain a comprehensive understanding of attitudes and perceptions toward AI.

3.2. Sample

An intervention and post-test experimental design was used. A non-random sample of 90 participants (51 women and 39 men) from two Tecnológico de Monterrey campuses was employed. Participants were from various academic programs within the School of Business. Sample selection was based on convenience, utilizing readily available students.

The average age of participants was 21.4 years (SD = 2.3), and all were enrolled in at least their second year of undergraduate studies.

3.3. Instrument

A structured survey, identical to that used in the original study, was employed. The survey used a 5-point Likert scale (1 = Totally disagree, 5 = Totally agree) to assess attitudes towards AI, perceived usefulness, academic commitment, and the

development of critical thinking skills. The survey was validated through expert judgment and a pilot test with 15 students, yielding a Cronbach's alpha of 0.92.

3.4. Data Analysis

In the original study, 66% of students indicated a strong preference for using AI over traditional methods for learning and problem-solving, with an additional 33% agreeing. No participants expressed disagreement or neutrality (see Table 1). Similarly, 66% of students strongly agreed that AI improved their reflection and research skills, while 33% agreed with this statement.

3.5. Comparison with the Expanded Sample

The expanded sample yielded similar overall results, but with some significant gender differences. For example, while 66% of students in the original study preferred using AI for problem-solving, in the new study, 57% of women strongly agreed with this preference, compared to only 39% of men. This pattern was repeated in other items related to AI use, particularly regarding the perceived improvement in research and reflection skills.

3.6. Comparison of Data Analyses

Data analysis was conducted in two phases:

1) *Quantitative analysis*: Descriptive statistics (mean, and standard deviation) were calculated for the survey responses. Comparisons between groups were made using appropriate statistical tests.

2) *Qualitative analysis*: The academic commitment, development of reflection, and research skills were analyzed with special attention on enhancing learning, critical thinking skills and exploring gender differences in AI adoption and perception.

3.7. Ethical Considerations

This research prioritized the ethical use of AI, by considering the crucial role of human perceptions, evaluation, and supervision. Additionally, informed consent was obtained from the students to participate in the study.

3.8. Study Limitations

This study presents some limitations that should be considered. Firstly, the sample was limited to students from a single degree program across two campuses, which may limit the generalization of results. Additionally, the study was cross-sectional, which does not allow for evaluation of the long-term effects of the SHAPE framework. Future studies could address these limitations through more diverse samples and longitudinal designs.

4. Results

4.1. Quantitative Analysis

According to the results obtained using the "Free Statistics and Forecasting Software (Calculators) v.1.2.1" [20] the instrument used in the study demonstrated acceptable internal consistency, with a Cronbach's Alpha of 0.928 for the complete scale and similar values when excluding individual items (range: 0.9098 - 0.9185). Both the standardized Cronbach's Alpha (0.9291) and the G6(smc) coefficient (0.9261) support the reliability of the measure. Additionally, the average correlation between each item and the corrected total score (Average R) was 0.6858, suggesting adequate homogeneity of the items.

Table 1: Student's survey results with gender differences

ITEM	SCALE				
	Strongly disagree	*Partially disagree*	*Neutral*	*Partially agree*	*Strongly agree*
I prefer to use activities that involve AI tools instead of traditional teaching methods to learn.	3%	4%	3%	15%	17%
I prefer to use activities that involve AI tools to help me solve problems in creative ways.	3%	1%	3%	19%	**24%**
I'm more involved in group discussions and projects that implement activities using AI tools.	3%	4%	7%	15%	**21%**
I consider my level of commitment to be higher during projects that require interaction with AI tools.	1%	6%	2%	**21%**	**27%**
Using AI tools helps improve my critical thinking skills for decision-making.	1%	6%	7%	15%	15%
I consider that my experience in activities using AI tools helps improve my critical thinking and research skills.	1%	1%	6%	12%	18%

4.2. General Descriptive Statistics

Student's t-tests revealed significant gender differences across several key dimensions:

1) Preference for AI Use: Women showed a greater preference for AI-related activities ($M = 4.33$, $SD = 0.88$) than men ($M = 4.11$, $SD = 0.95$), with a statistically significant difference ($t(88) = 2.05$, $p = 0.043$, $d = 0.24$).

2) Academic Commitment: Women also reported a higher level of academic commitment to using AI ($M = 4.21$, $SD = 0.82$) compared to men ($M = 3.65$, $SD = 0.99$) ($t(88) = 2.93$, $p = 0.004$, $d = 0.61$).

3) Development of Reflection and Research Skills: Women perceived a greater improvement in these skills ($M = 4.45$, $SD = 0.76$) than men ($M = 3.92$, $SD = 0.89$) ($t(88) = 3.16$, $p = 0.002$, $d = 0.65$).

4.3. Qualitative Analysis

Qualitative content analysis revealed that women described AI as a tool that "facilitates autonomous learning" and "promotes deep reflection," while men focused more on its practical functionality, indicating a preference for AI due to its ability to "optimize tasks" and "solve problems efficiently." Both genders agreed that AI improved their critical thinking skills, although women emphasized its impact on reflection more strongly.

5. Discussion

This study confirms that overall perceptions of AI remain positive among undergraduate students, as observed in the original study by Rodríguez Maya [3]. The larger sample size in this study allowed for the identification of significant gender differences. Specifically, women demonstrated greater acceptance and commitment to AI, particularly in developing reflection and research skills, while men showed a preference for using AI to solve practical problems. This distinction is important as it highlights the potential for tailoring educational strategies to leverage these different strengths and preferences.

These results align with previous studies suggesting that women tend to value technological tools that facilitate collaboration and autonomous learning more highly [4], [5]. Bandura's self-efficacy theory [18] may further explain why women, who experience higher self-efficacy when engaging with AI, perceive a greater impact on their reflective and critical thinking skills. This connection underscores the importance of fostering environments that build self-efficacy to support deeper engagement with AI tools.

Nevertheless, this study differs from other research on the acceptance and use of AI tools in education. For example, Kingsley Ofosu-Ampong's work reveals different results, showing how men and women in Ghana interact with and perceive

AI tools in educational settings [21]. The contrasting outcomes between the two studies can be attributed, in part, to cultural differences between Ghana and Mexico.

Ghana's cultural context, characterized by high power distance, collectivism, and moderate masculinity, suggests that traditional gender roles and hierarchical structures significantly influence women's adoption of technology [22]. Women in Ghana may perceive technology as more complex or less user-friendly due to limited exposure and support. These perceptions align with Ofosu-Ampong's findings, indicating that men have a more favorable view of AI tools, bolstered by greater familiarity and confidence in using them.

In contrast, while Mexico also exhibits high power distance and masculinity, it benefits from a more indulgent culture and increased support for educational programs that encourage technology use among women. Initiatives aimed at enhancing digital literacy and supporting women's participation in STEM fields have contributed to a higher perception of value and usability of technology among Mexican women compared to their Ghanaian counterparts [23, 24].

In international assessments such as the PISA test, girls achieve significantly higher average scores than boys in reading across all 65 evaluated countries. In mathematics there are no significant differences between genders in Mexico [25].

Specifically, students at Tecnológico de Monterrey are accustomed to the intensive use of information and communication technologies (ICT) in their education, reflecting an academic environment that promotes the integration of digital tools to enhance learning and the development of critical skills [26]. This familiarity with technology is evident in the adoption of innovative teaching models and the frequent use of computing devices.

These cultural differences help explain why gender disparities in technology acceptance may be more pronounced in Ghana than in Mexico, despite both countries facing challenges related to traditional gender roles.

Understanding these differences through Hofstede's cultural dimensions—such as power distance, masculinity, and uncertainty avoidance—provides valuable insights into the socio-cultural factors that shape gendered perceptions of technology. While Ghana's rigid structure and lower long-term orientation hinder women's engagement with AI tools, Mexico's recent strides in promoting inclusivity and technological compatibility create a more supportive environment for women's participation. These insights can guide future research and inform policy-making to address gender disparities in technology use.

5.1. Implications and Future Directions

The study highlights the need to address the gender differences in AI usage and attitudes. The findings suggest a need for pedagogical approaches that are more inclusive and responsive to individual learning styles, particularly considering gender differences. Educators should tailor AI integration to support both collaborative, reflective learning (beneficial for women) and task-focused, efficient learning (beneficial for men).

Future research could explore longitudinal analysis tracking student engagement with AI tools over time to provide data on the long-term impacts on learning and skill development, accounting for gender. Also, replicating this study with larger and more diverse samples (socioeconomic status, ethnicity, academic disciplines, etc.) would strengthen the generalizability of the findings. Finally, more in-depth qualitative research exploring the underlying reasons behind gender differences in AI perception and use could inform more effective educational intervention strategies

6. Conclusion

This study corroborates the original findings regarding AI's effectiveness in improving learning and the development of critical thinking skills among university students. However, the inclusion of a larger and more diverse sample revealed significant gender differences, highlighting that women tend to benefit more from AI tools in terms of reflection and research skills, while men tend to value them more for their practical utility.

These findings have important implications for the design of pedagogical strategies aimed at maximizing the inclusive impact of AI in higher education. Educational institutions should consider individual differences in the perception and use of AI to promote a more equitable and effective adoption of these technologies.

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