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# ASSESSING AI INTEGRATION IN EDUCATION: A COMBINED TAM AND STIMULUS–ORGANISM–RESPONSE FRAMEWORK: A CASE STUDY OF PUBLIC SECTOR UNIVERSITIES OF PAKISTAN

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**Abstract**
*The current research aims to examine the relationship between faculty members' willingness to adopt artificial intelligence (AI) apps in Pakistani institutions and their self-efficacy level. It provides a deep insight into the acceptability of technology in the learning institutions by merging two significant theoretical frameworks, namely; Stimulus- Organism- Response (S-O -R) model, and the Technology Adoption Model (TAM). Data was collected from the 422 faculty members in Pakistani public universities in Pakistan. The results make it clear that there is a relationship between the intention to use AI technologies in learning facilities and self-efficacy, relative utility, ease of use, and cognitive attitude toward technology. This research study contributes to the body of AI adoption research by combining TAM and S-O-R, with self-efficacy being identified as an essential determinant of attitudes and behavioral intentions towards the adoption of AI in academic institutions. To foster positive attitudes and a rise in the successful adoption of AI in instruction, universities need to improve faculty self-efficacy with AI-related training and easily accessible systems.*

## 1. Introduction

Owing to technological change and modernity, the educational system has shifted drastically. (Chan, 2025). Although the use of AI-based educational technologies in Pakistani institutions of higher education has become more prevalent, their acceptance and utilization in every case is relatively horizontal and hinges on the perceptions and willingness of certain faculty members to use these technologies in their work (Asad, 2025). Most studies have examined the acceptance of educational technologies among students, and comparatively few studies have given relevance to the views of the faculties especially in third-world nations like Pakistan (Ikram, 2025). In this work, which is based on the Technology Acceptance Model (TAM), the impact of perceived usefulness and perceived ease of use on influencing the faculty attitude toward AI applications is given significant consideration. Also, incorporating the Stimulus-Organism-Response (S-O-R) model, the research conceptualizes self-efficacy as a key stimulus affecting cognitive and affective reactions that eventually predetermine behavioral intention to adopt AI. The proposed approach is indicative of a significant literature gap because it has provided a comprehensive explanation of the AI adoption behavior among faculty members in the

context of institutional and policy factors of Pakistani higher education.

Advancing the further digitalization of Pakistani higher education. The adoption of technology has become of more crucial importance as the subject of innovative teaching and learning in recent studies (Saboor, 2025). Instruments of learning that are based on the use of technology become central in the attainment of pedagogical targets through the improvement of the delivery of instructions and transformation of teaching and learning approaches (Chan, 2025). This change is even faster due to the presence of institutional facilities, which help in technology-enabled instruction, which highlights the key role that digital tools have in contemporary education settings (Asad M. M., 2025).

There is empirical evidence indicating that the perception of technology by the faculty members, their ability, and the skills they have in utilizing the digital tools are determinants in the primary aspect of the initial acceptance and the ongoing use of educational technologies (Saboor, 2025). Previous research has shown that the successful use of technology increases the capacity of teachers to intervene with students, which has a direct impact on the quality of instruction and learning (Kabakus, 2025). Besides, the willingness of teachers to embrace technology largely determines their pedagogical methods, classroom practices, and the effectiveness of teaching delivery.

Although this has been understood, the most available research majorly emphasizes general educational technologies, or student-controlled adoption, with little empirical consideration of faculty support of more advanced AI-based tools, specifically in the framework of publicly-funded universities in the developing world, like Pakistan. In addition, although it has been shown that previous studies have applied one of the models to the issue, including the Technology Acceptance Model (TAM), or psychological models, few have conducted empirical research to combine cognitive perceptions and behavioral reactions to determine the willingness of faculty members to adopt AI. This inanity of truth to the theories and contextual analysis is a vital gap in the literature.

### 1.1 Problem Statement

Despite the growing number and engagement of Pakistani institutions of higher education in AI-enabled educational technologies and digitization efforts at the national level, this trend limits the successful application of these solutions due to the willingness and readiness of faculty members (Asad M. M., 2025). The lack of awareness about the role of self-efficacy, as well as technology-related perceptions in the intention to use AI applications by faculty members, restrains the effective employment of AI in teaching and learning (Ikram, 2025). To solve this challenge, there is a need to adopt a theory-based and empirically established framework that will reflect both cognitive and behavioral aspects of technology acceptance in the minds of the faculty members.

In the literature, the central importance of the attitude and technical competencies of teachers to the successful implementation of the use of technology in the education process is emphasized (Chan, 2025). Based on this background, the proposed research seeks to investigate how self-efficacy affects the intention of the members of the faculty to embrace artificial intelligence (AI) technologies in Pakistani universities. In particular, it explores how the belief in the effectiveness of AI as a teacher affects the attitude towards AI use, the degree of interaction with such technologies, and the intentions towards behavioral change of applying AI in teaching classroom activities.

## 2. Literature Review

The importance of self-efficacy has become evident in enabling people to adopt artificial intelligence in educational settings because it is one of the key factors influencing how teachers view, treat, and interact with new technology (Taschner, 2025). People who have high self-efficacy rates find it easier to accept emerging challenges, have resilience when it comes to various difficult situations, and engage in enduring persistence in completing assigned tasks (Sun, 2025). In a conceptual sense, self-efficacy is a combination of beliefs by an individual that they can plan and

perform the actions necessary to attain desired results (Taschner, 2025). According to previous research, self-efficacy has been known to make people more active in starting communication, not giving up once hit by some barriers, and trying to acquire the skills that could make them competent in using the technology (Sun, 2025). Empirical results also show that self-efficacy is an important determinant of human behavior and has direct as well as indirect influences on the intention of using technology and actual behavior of technology use (Yang, 2025). Therefore, the self-efficacy not only determines the technology acceptance but also predetermines the intensity of adoption and the quality of utilization by which the technological tools should be applied in multiple spheres, including the educational one (Mekheimer, 2025).

The empirical research is quite strong in demonstrating the importance of self-efficacy in the process of adopting artificial intelligence in the educational field (Mekheimer, 2025). As an example, Wang et al (2021) showed that self-efficacy, along with attitudinal variables, explained a high percentage of the difference in the intention of educators to apply AI technologies. Their results show that teachers who have more self-efficacy are more willing to use AI in their teaching practices. Further, the research also showed that self-efficacy has a positive impact on educators' attitudes towards the ease of use and creation of a more positive attitude towards the use of AI-based applications, which is also crucial in determining cognitive and affective reactions to the adoption of technologies (Mekheimer, 2025).

Masril (2021), on his part, added additional knowledge on the application of AI in education by highlighting the relevance of perceived usefulness. The researchers established that the level of teaching assessments and acceptance of AI technologies is determined greatly by the degree to which the technological tools are viewed as helpful and efficient (Chan C. K., 2023). When AI applications are perceived as beneficial, teachers will be more convinced to sense a positive attitude and show a greater desire to use them in an educational setting (Saade, 2005; Mohamed, 2025). All of these findings highlight the mutual influence of self-efficacy and perceived usefulness in attitude and behavioral intentions, and indicate that the enhancement of self-efficacy is crucial to the successful adoption and successful use of AI technologies in the education process.

The paper combines the Stimulus-Organism-Response (S-O-R) (Mehrabian, 1974) framework and the Technology Acceptance Model (TAM) (Davis, 1989) to analyze the behavioral intention of faculty members to accept artificial intelligence in the situation of Pakistani universities. Self-efficacy in the proposed conceptual model is conceptualized as the main stimulus that may moderate internally affect the cognitive and affective states of educators, which is also known as organism factors. Such organism variables are perceived usefulness, perceived ease of use, and attitude that is a result of TAM and is a critical predictor of technology acceptance. Faculty members and their behavioral intention to use AI technologies reflect the response component of the model.

TAM offers a solid basis for the technology adoption in organisations by highlighting the extent to which usefulness and ease of use are evaluated by individuals in forecasting acceptance (Davis, 1989). Determining such perceptions will enable organizations to develop better strategies that can enable them to implement technologies successfully. Combining TAM and the S-O-R framework, it will be possible to understand the psychological and behavioral processes underlying the adoption of AI in a comprehensive manner. In line with this, the main aim of the research is to explore how self-efficacy influences the intention of faculty to use AI either directly or indirectly via the perceived usefulness, perceived ease of use, and attitude. This connected framework is a view of the overall technological acceptance in the teaching context and is the foundation of formulating hypotheses of the study.

**Hypothesis Development**

**Hypothesis 1 (H1):**

Self-efficacy positively influences perceived usefulness.

**Hypothesis 2 (H2):**
Self-efficacy positively influences attitude.

**Hypothesis 3 (H3):**
Self-efficacy positively influences perceived ease of use.

**Hypothesis 4 (H4):**
Perceived usefulness positively influences attitude.

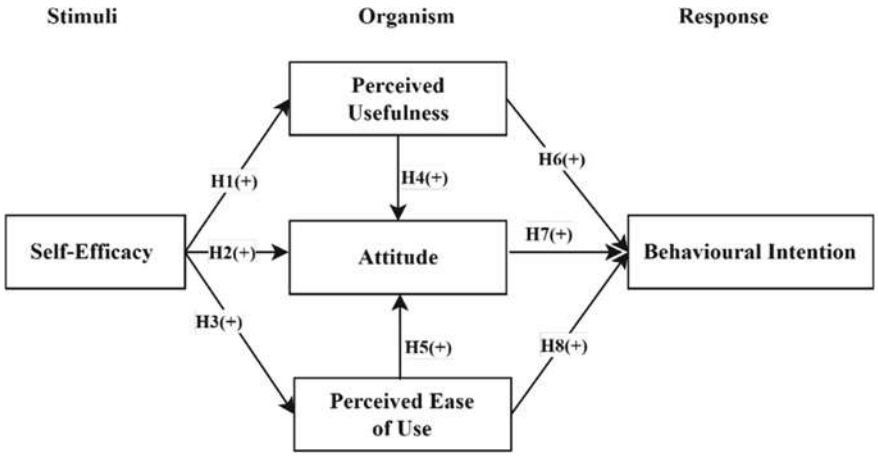
**Hypothesis 5 (H5):**
Perceived ease of use positively influences attitude.

**Hypothesis 6 (H6):**
Perceived usefulness positively influences behavioral intention.

**Hypothesis 7 (H7):**
Attitude positively influences behavioral intention.

**Hypothesis 8 (H8):**
Perceived ease of use positively influences behavioral intention.

### 2.1 Theoretical Framework




### 2.2. Technology Acceptance Model (TAM) as Theoretical Foundation

The Technology Acceptance Model (TAM) developed by Davis (1989) offers a powerful model of comprehending the adoption of technology. In TAM, a behavior intention of using technology is mainly influenced by perception of usefulness, i.e., the levels at which technology improves job performance, and perceived ease, i.e. the levels at which there is an opinion that technology will make the tasks easy. Such beliefs determine the attitude to technology, which subsequently affects the intentions to adopt.

TAM has also been actively used in the learning process to analyze its acceptance among teachers concerning e-learning tools, learning management systems, and AI-based applications (Venkatesh, 2000; Mlekus, 2020; Teo, 2011). When the members of the faculty feel that AI is useful and easy to use, they are more likely to implement it in their teaching and achieve better teaching practices.

In this paper, TAM is deepened with self-efficacy as the antecedent, which is the mental conviction of having the ability to appropriately utilize AI (Ramadania, 2019). The combination will allow studying the role of self-efficacy in its impact on the perceived usefulness, ease of use, and attitude, which will eventually determine the behavioral intention to use AI in Pakistani universities.

### 2.3. S-O-R Framework

The following is a brief yet impactful paragraph on the Stimulus-Organism-Response (S-O-R) model written academically and will fit in anywhere in your research paper:

Mehrabian and Russell (1974) developed the Stimulus-Organism-Response (S-O-R) framework,

which is a comprehensive theoretical model since it explains how external stimuli affect individual behavior using an internal cognitive and affective system. The framework states that it is environmental or psychological stimuli (S) that influence the internal state (O) of an individual in the form of perceptions, emotions, and attitudes and result in behavioral response (R). The S-O-R model has already been used in the studies of the adoption of technologies and education to interpret the role of personal and situational factors that can influence user perceptions and decisions (Liu, 2025). Self-efficacy, in the framework of the given study, is perceived as an important stimulus affecting internal analysis of faculty members, including the perceived usefulness, perceived ease of use, and attitude, consequently, defining their intention to gain artificial intelligence as part of educational activities. The S-O-R model can provide a strong base to study AI adoption in higher education because it allows identification of the chronological interdependence between stimuli, cognitive responses, and behavioral consequences.

### 2.4. The combination of the TAM and the S-O-R Framework.

This paper combines the Technology Acceptance Model (TAM) and Stimulus-Organism Response (S-O-R) model to get a holistic view of faculty members' intention to use AI in Pakistani universities. The central stimulus (S) in this integrated model is that of self-efficacy, which can be viewed as the belief that the educators have the capacity to use AI effectively. TAM factors include the perception of usefulness, ease of use, and attitude that have been grouped in the internal organism (O) factors and are influenced by this stimulus. A combination of these organizational factors identifies the response (R), which is an intention of the faculty members to use AI, manifested through their behaviors.

The model integrates the TAM and S-O-R since it encompasses both cognitive (usefulness and ease of use) and psychological (self-efficacy and attitude) assessment of AI and adoption behavior. Such interaction may be analyzed to a greater extent with the adoption of this integration, which will help draw a clearer picture of what personal beliefs and perceptions in interaction are doing to influence the faculty involvement with AI technologies.

Such a combined strategy not only expands TAM through the involvement of psychological stimuli but also offers a theoretically based reasoning of the adoption behavior of faculty members regarding AI, especially among Pakistanian higher education institutions.

## 3. Research Methodology

The research approach of this study is positivist, which refers to the focus on empirical data and the use of a systematic measurement of variables in order to determine which patterns and relationships exist between variables with the help of quantitative analysis (Shahid, 2022). The research design was a cross-sectional one to obtain a picture of perceptions of faculty members on the use of AI in Pakistani state universities, avoiding changes across time (Agha, 2025).

The population was limited to the members of the faculty of Pakistani public universities, and the use of convenience sampling was done to gather primary data. Five hundred and twenty-five members of the faculty were invited to take part, and 451 of them gave their responses. The 422 valid responses were used after filtering on completeness and eligibility, giving an effective response rate of 80.4% percent.

Primary data was gathered through a self-administered questionnaire, which was developed out of a wide extent of literary reading. The questionnaire was first of all drafted in English and thereafter translated into Urdu to come up with clarity and proper responses. The period of data collection was October 3, 2025 to November 29, 2025. The questionnaire had an introduction section that defined the aim of the research, a voluntary section, and next section of the questionnaire further defined the right of withdrawal, and ethical considerations on how data will be handled. It also included demographical questions and questions assessing

the key constructs based on a Seven-point Likert scale (1 strongly disagree, 7 strongly agree).

### 3.1 Construct measurement

**Self-efficacy:** 5 questions based on Ni and Cheung (2023). Perceived usefulness and perceived ease of use: 5 each, based on Ala'a (2023). Attitude: 3 Abdul-Halim, (2022). In addition, the behavioral intention to use AI 3 items that were borrowed from studies in (Alsharo, 2021). The study data were analyzed in two phases, which also guaranteed not only the reliability but also the validity of the measurement model and evaluated the structural relationships between the constructs.

## 4. Analysis and results of the research.

The analysis of data is done in two phases. The descriptive statistics using means, standard deviation, and correlations were the first step in the analysis, which provided an overall idea of the data patterns. The second step involved the Structural Equation Modeling (SEM) that was adopted to test the direct correlations among the variables, determine path coefficients, and investigate the model fit measures. The two-step method allowed performing a thorough evaluation of measuring qualities and the structural connection among the variables in the research framework (Shahid, 2022).

### 4.1 Assessment of the Measurement Model

The measurement model was evaluated to determine the reliability and validity of the latent constructs that included the convergent validity, discriminant validity, and composite reliability. The findings of the confirmatory factor analysis (CFA) are shown in Table 1.

**Table 1: Factor Loadings, Composite Reliability (CR), and Average Variance Extracted (AVE)**

| Construct | Item | Factor Loading | CR | AVE |
|---|---|---|---|---|
| Self-Efficacy (SE) | SE1 | 0.742 | 0.863 | 0.548 |
| | SE2 | 0.765 | | |
| | SE3 | 0.702 | | |
| | SE4 | 0.693 | | |
| | SE5 | 0.720 | | |
| Perceived Usefulness (PU) | PU1 | 0.678 | 0.851 | 0.518 |
| | PU2 | 0.712 | | |
| | PU3 | 0.695 | | |
| | PU4 | 0.658 | | |
| | PU5 | 0.687 | | |
| Perceived Ease of Use (PEU) | PEU1 | 0.674 | 0.846 | 0.521 |
| | PEU2 | 0.689 | | |
| | PEU3 | 0.693 | | |
| | PEU4 | 0.653 | | |
| | PEU5 | 0.682 | | |
| Attitude (ATT) | ATT1 | 0.715 | 0.832 | 0.556 |
| | ATT2 | 0.728 | | |
| | ATT3 | 0.701 | | |
| Behavioral Intention (BI) | BI1 | 0.728 | 0.846 | 0.608 |
| | BI2 | 0.742 | | |

| Construct | Item | Factor Loading | CR | AVE |
|---|---|---|---|---|
| | BI3 | 0.721 | | |

*Notes:* CR = Composite Reliability; AVE = Average Variance Extracted. Factor loadings > 0.50, CR > 0.70, and AVE > 0.50 indicate acceptable reliability and validity.

**Table 2: Discriminant Validity (Fornell-Larcker Criterion)**

| Construct | SE | PU | PEU | ATT | BI |
|---|---|---|---|---|---|
| SE | 0.740 | | | | |
| PU | 0.421 | 0.719 | | | |
| PEU | 0.397 | 0.334 | 0.722 | | |
| ATT | 0.365 | 0.289 | 0.234 | 0.746 | |
| BI | 0.312 | 0.276 | 0.228 | 0.518 | 0.780 |

*Notes:* Diagonal values represent the square root of AVE; off-diagonal values represent correlations between constructs.

The latent constructs were all strongly and positively correlated with the indicators, with their factor loading ranging from 0.653 to 0.765 (which is higher than 0.50, the recommended level) (Shamaileh, 2023). The convergence validity was verified because the average values of variance extracted (AVE) were between 0.518 and 0.608, which exceeds the acceptable threshold of 0.50 (Al-Zyadat, 2022; Shahid, 2022). These findings prove the reliability and validity of the measurement model and form a strong basis for the structural model analysis.

**Structural Model Evaluation**

A structural model was used to test the hypothesized construct relationships and test the predictive ability of the proposed structural model. The structural Equation Modeling (SEM) was used to provide estimates of path coefficients, levels of significance, and general model fit.

It was found that self-efficacy had a major impact on perceived usefulness ( p = 0 = -0.325/= 0.421, p < 0.001), perceived ease of use ( p = 0 = -0.325/= 0.397, p < 0.001), and attitude toward the use of AI ( p = 0 = -0.325/= 0.365, p < 0.001). Both perceived usefulness ( = 0.289, p < 0.001) and expected ease of use ( = 0.234, p < 0.01) had significant effects on attitude, which, in its turn, had a positive effect on behavioral intention to adopt AI ( = 0.518, p < 0.001).

**Table 3: Structural Model Results (Path Coefficients and Significance)**

| Hypothesis | Path | β | t-value | p-value | Supported? |
|---|---|---|---|---|---|
| H1 | SE → PU | 0.421 | 7.892 | <0.001 | Yes |
| H2 | SE → PEU | 0.397 | 6.543 | <0.001 | Yes |
| H3 | SE → ATT | 0.365 | 5.978 | <0.001 | Yes |
| H4 | PU → ATT | 0.289 | 4.321 | <0.001 | Yes |
| H5 | PEU → ATT | 0.234 | 3.876 | <0.01 | Yes |
| H6 | ATT → BI | 0.518 | 8.210 | <0.001 | Yes |

| Hypothesis | Path | β | t-value | p-value | Supported? |
|---|---|---|---|---|---|
| H7 | PEU → BI | 0.354 | 5.56 | <0.001 | Yes |
| H8 | PU → BI | 0.347 | 6.74 | <0.001 | Yes |

This model showed good fit measures, which validated the suitability of the given framework. In general, the findings show that self-efficacy influences the behavioral intentions of the faculty members indirectly via TAM-based organism variables, which are perceived usefulness, perceived ease of use, and attitude. Such results indicate the significance of self-efficacy in positive attitude and intention towards AI adoption among Pakistani university faculty.

**Table 4: Model Fit Indices**

| Fit Index | Recommended Value | Observed Value |
|---|---|---|
| $\chi^2$/df | < 3 | 2.78 |
| RMSEA | < 0.08 | 0.061 |
| CFI | > 0.90 | 0.932 |
| TLI | > 0.90 | 0.924 |
| SRMR | < 0.08 | 0.058 |

Most of the goodness-of-fit indices were used to measure the overall model fit. These findings suggest that the proposed model shows that its fit to the data is good. The value of chi-squared to the degrees of freedom /( 2.78/df = 2.78) is less than the value recommended (3), which indicates a good fit of the model. Both the Root Mean SquareError of Approximation (RMSEA = 0.061) and StandardizedRoot Mean Square Residual (SRMR = 0.058) are within a reasonable range, meaning there are few residuals. Moreover, the Comparative Fit Index (CFI = 0.932) and the Tucker-Lewis Index (TLI = 0.924) surpass the recommended cut-off value of 0.90, which again guarantees the adequacy of the model. All these indicators give evidence that the structural model represents the observed information quite well.

## 5. Discussion and Conclusion

This paper discussed the impact of self-efficacy on the intention of faculty members to use AI technologies in Pakistani institutions as a combination of the Technology Acceptance Model (TAM) and the Stimulus-Organism-Response (S-O-R) model. The results give a theoretical and practical understanding of the processes of AI adoption in higher education.

In line with TAM and earlier studies Ramadania, (2019), Shao, (2025), self-efficacy was found to be an important predictor of perceived usefulness, perceived ease of use, and attitude towards AI adoption. Members of the faculty, who had confidence in their competence and capacity to use AI, expressed more positive views on the application of such technologies as useful and convenient in their work, thus demonstrating more positive attitudes (Sikarwar, 2025). This is consistent with Bandura's (2006) theory of self-efficacy, that believes that people who have more confidence in their abilities tend to take up new tasks and continue to attain what they want. These findings are also in line with an empirical study by Wang (2021) and Masril (2021), who indicate that self-efficacy reinforces the existence of perceived ease and usefulness of AI tools, increasing the chances of its adoption in educational settings.

The paper also established that attitude was significantly affected by perceived usefulness and perceived ease of use and had a positive effect on behavioral intention to adopt AI (Wiprayoga,

2023). These findings confirm the predictive value of TAM in understanding technology adoption behavior, in that cognitive assessments of usefulness and effort influence both the attitudes and highly favorable intentions (Sharma, 2019). This study expands the classical models of technology adoption by incorporating the TAM model together with the S–O-R framework because psychological stimulus (self-efficacy) is an important antecedent that transfers into cognitive and affective responses, which, in turn, influence the outcome (behavioral).

Practically, the results highlight the necessity to build faculty self-efficacy as one of the strategies that help promote the adoption of AI. To boost confidence among educators with regard to using AI tools, universities and policymakers can establish specific training courses, workshops, and support systems. Moreover, it is possible to encourage beneficial attitudes and intentions to adopt AI technologies by making sure they are seen as handy, convenient, and simple to implement in classrooms. The insights offer value, especially in the case of digital transformation towards higher education in Pakistan, where the momentum towards digital transformation initiatives is starting to gain depth.

In conclusion, this paper proves that the concepts of self-efficacy not only affect the attitudes towards AI directly but also indirectly influence the behavioral intentions through perceptions of usefulness and the ease of use as a cohesive idea that can be used to explain the interest of faculty members in engaging with AI technologies. The findings can be used to validate the theoretical framework and offer practical suggestions towards encouraging AI adoption in higher education by connecting psychological, cognitive, and behavioral aspects.

### 5.1 Research Implication

#### Theoretical Implications

The study is beneficial to the literature since it adds TAM by incorporating self-efficacy as a psychological motivator into the SOR model. The research has identified the interrelationship between cognitive (perceived usefulness, ease of use), affective (attitude), and behavioral (intention) elements in the adoption of technology. It gives empirical support to the fact that self-efficacy directly and indirectly determines behavioral intention to deliver a more comprehensive picture of the impact of technology acceptance in higher education.

#### Practical Implications

The findings provide policymakers and faculty with practice. The focus of the universities should be placed on training programs, workshops, and constant support that will lead to higher faculty self-efficacy in using AI. Incorporation of AI tools designed in a user-friendly and efficient way, and which have pedagogical worth, will further promote adoption. These insights can be utilized by policymakers to devise solutions and policies that can result in the readiness of the faculty so that AI can be successfully implemented in the educational experience, and lead to the larger digitalization of higher education.

#### Limitations and Future Research.

Certain limitations should be taken into account in this study. To begin with, the cross-sectional design only gives a picture of what the faculty thought at a single instance in time and does not allow one to make causal assumptions. Longitudinal studies would be able to highlight any attitude or adoption behavior changes over a period. Second, the paper only discussed Pakistani state universities, which might also be restrictive to the ability to generalize the results to other academic or cultural settings. Future studies might consider comparative studies on a cross-country, cross institutional, and cross-disciplinary level and also investigate other variables, including organizational support and technological infrastructure, which might have an impact on AI adoption.

To sum up, this research paper shows that self-efficacy is a critical force behind the adoption of AI in higher education, and both theoretical and practical opportunities exist to strengthen the technological integration. By overhauling the psychological, cognitive, and behavioral

orientation, universities can be in a better position to exploit the advantage of AI, which eventually transforms teaching and learning in the digital age.

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