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# INFLUENCES OF PERCEIVED USEFULNESS AND PERCEIVED EASE OF USE ON ACADEMIC ACHIEVEMENT: MEDIATING ROLE OF MOTIVATION

## INFLUENCIAS DE LA UTILIDAD Y FACILIDAD DE USO PERCIBIDA EN EL LOGRO ACADÉMICO: EL PAPEL MEDIADOR DE LA MOTIVACIÓN

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ABSTRACT

Technology adoption has significantly reshaped the higher education landscape, influencing how students engage with academic content and achieve their learning goals. By utilizing the Technology Acceptance Model (TAM), this study explored the role of the adoption of technology in shaping academic achievement. This study examines the role of Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) in influencing Academic Achievement (CGPA). Consequently, this study seeks to (1) analyze the relationship between PU, PEOU and CGPA, and (2) identify the role of Motivation as a mediator. To explore these relationships, a survey of over 200 undergraduates was conducted, and the data was analyzed using SMART PLS. The findings reveal a strong correlation between PU, PEOU and CGPA. The findings confirm that technology adoption significantly impacts academic achievement. Nevertheless, amplification of these can be observed when motivation is linked to it. The data revealed that students who effectively utilize digital tools and platforms tend to perform better. This research contributes to the ongoing discourse on technology adoption and academic achievement, offering insights for educators, policymakers, and institutions to optimize digital tools for learning. It highlights the necessity to develop strategies that foster positive technology adoption behaviors, ensuring undergraduates to effectively leverage digital resources. By aligning instructional design with the principles of TAM, institutions can enhance motivation, reduce learning barriers and improve overall academic outcomes.

Keywords:

Perceived usefulness, perceived ease of use, motivation, academic achievement, SMART PLS.

RESUMEN

La adopción de tecnología ha transformado significativamente el panorama de la educación superior, influyendo en cómo los estudiantes interactúan con el contenido académico y alcanzan sus metas de aprendizaje. Mediante el Modelo de Aceptación de Tecnología (TAM), este estudio exploró el rol de la adopción de tecnología en la configuración del rendimiento académico. Este estudio examina el rol de la Utilidad Percibida (PU) y la Facilidad de Uso Percibida (PEOU) en la influencia del Rendimiento Académico (CGPA). En consecuencia, este estudio busca (1) analizar la relación entre PU, PEOU y CGPA, y (2) identificar el rol de la Motivación como mediadora. Para explorar estas relaciones, se realizó una encuesta a más de 200 estudiantes de pregrado y los datos se analizaron utilizando SMART PLS. Los hallazgos revelan una fuerte correlación entre PU, PEOU y CGPA. Los hallazgos confirman que la adopción de tecnología impacta significativamente el rendimiento académico. Sin embargo, se puede observar una amplificación de estos factores cuando la motivación se vincula a ellos. Los datos revelaron que los estudiantes que utilizan eficazmente las herramientas y plataformas digitales tienden a tener un mejor rendimiento. Esta investigación contribuye al debate actual sobre la adopción de tecnología y el rendimiento académico, ofreciendo perspectivas para educadores, legisladores e instituciones para optimizar las herramientas digitales para el aprendizaje. Destaca la necesidad de desarrollar

estrategias que fomenten comportamientos positivos de adopción de tecnología, asegurando que los estudiantes universitarios aprovechen eficazmente los recursos digitales. Al alinear el diseño instruccional con los principios de TAM, las instituciones pueden mejorar la motivación, reducir las barreras de aprendizaje y mejorar los resultados académicos generales.

Palabras clave:

Utilidad percibida, facilidad de uso percibida, motivación, logro académico, SMART PLS.

## INTRODUCTION

Technology has become an integral part of modern education. It changes how students learn, interact and engage with academic content. With digital tools, online platforms and virtual resources now widely available, the way undergraduates approach their studies has evolved (Akpen et al., 2024). This study explores how technology adoption shapes academic achievement. At the same time, it shades light on whether using digital tools can truly enhance learning outcomes. At the heart of this research is a key question: How does technology adoption impact academic achievement? To answer this, data obtained from 257 undergraduates were analyzed using SEM SMART PLS. This approach managed to uncover patterns and relationships between technological adoption and academic achievement. The findings revealed a clear link which confirms that students who actively use technology for learning tend to achieve better academically. Factors such as PU, PEOU and Motivation are key in shaping the relationship (Kim et al., 2025). The results suggest that when technology is used strategically, it can enhance learning experiences and lead to improved academic outcomes (Shahraniza et al., 2025).

Ultimately, this study highlights the growing importance of digital tools in education. By understanding how technological adoption affects learning, educators and HLIs can develop better strategies to support undergraduates. This not only contributes to ongoing discussions on digital education but also offers practical recommendations for making the most of technology in the classroom.

Review of the related literary work was done to explore the theoretical underpinnings and empirical findings related to perceived usefulness, perceived ease of use, motivation and academic achievement. Research was done on how these constructs have been conceptualized, measured and interrelated in prior proceedings and papers. This review aims to establish foundation for this study which investigates how the technology adoption shapes academic achievement.

Davis (1989), was the original creator of TAM. TAM suggests that individuals' behaviour is influenced by their intention. This in turn is shaped by their attitudes and subjective norms. It continues to be one of the most influential frameworks in understanding the ways and the reasons for people to adopt technology (Pund et al., 2023; Alyoussef, 2023). It is particularly valuable in education settings where technology is continuously being integrated into learning processes. Davis (1989), adapted this model to technology adoption. He argued that a user's actual system use is determined primarily by behavioural intention which is influenced by two key perceptions: Perceived Usefulness and Perceived Ease of Use. These fundamental pillars of TAM offer a focused lens for examining undergraduates' willingness to engage with technology.

PU signifies the belief that individual holds regarding the usage of technology in enhancing their achievement. In educational settings, this means he or she is prone to accept the use of technology when they trust its enhancement to the academic achievement (Zhou et al., 2022). Several studies confirm that undergraduates are expected to use technology when it is useful for their educational grades (Venkatesh & Bala, 2008). In addition to that, Al-Rahmi et al. (2018), research findings discovered academic collaboration in terms of engagement with social media was significantly influenced by the PU.

PEOU indicates how much a person feels that accepting technology will be easy and effortless (Davis, 1989). Within the TAM, PEOU is one of the key influencing to a learner's attitude towards technology and subsequently their intention on using it. Various studies, without fail, have found that when it is effortless to use educational technology, it is likely to be adopted and integrated in learning practices (Al-Rahmi et al., 2022; Alharbi & Basiouni, 2025). Digital learning platforms with intuitive design and clear user interfaces are adopted more readily compared to those without it. This has reinforced the importance of PEOU in influencing academic achievement. To add to this, when students encounter minimal effort in navigating academic technology, their motivation to utilize these digital technologies tends to increase and led to enhanced academic achievement.

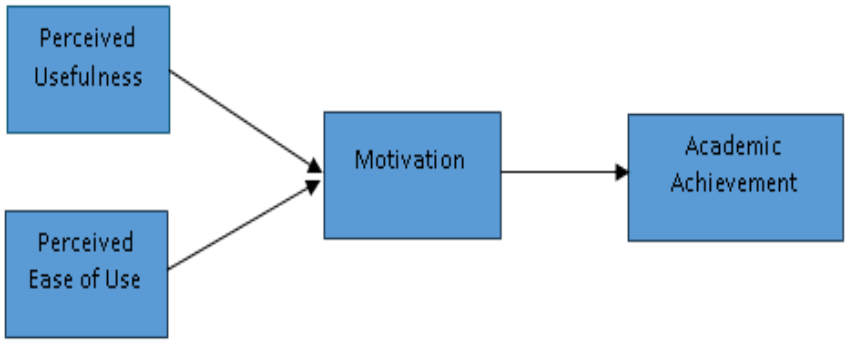
Several theories provide a framework for understanding the connection between motivation and academic achievement. Among them is Self Determination Theory (SDT) which was developed by Deci & Ryan (1985). They postulated that motivation exists on a continuum from intrinsic to extrinsic with intrinsic being the closest factor that leads to improved academic achievement. SDT indicated that when learning environments are supportive, learners are prone to be intrinsically motivated. This led to elevated academic achievement (Ryan & Deci, 2000).

In the context of technology adoption, motivation can influence how students engage with new technologies and how these technologies eventually affect their academic achievement. Research by Puentedura (2006), on SAMR model of technology integration mentioned students can improve their achievement if they are motivated to utilize technologies that are associated with their academic goals. The authors Also et al. (2013), found that students who are motivated and enjoyed using educational technology for intrinsic reasons are more likely to experience enhanced academic outcomes. In Malaysia, Mohd et al. (2024), investigated the influence of student motivation on academic performance among undergraduates. Their study pointed out that motivation significantly boosts academic success, with regression analysis revealing motivation as a strong predictor of higher academic achievement. Another study by Bozkurt & Sharma (2022), discovered a significant relationship between motivation and learning outcome. This suggests that motivated students tend to achieve better academic results in specific subjects.

Academic Achievement is about how well a student has reached their learning goals within the short or long term. Normally, this is obtained from CGPA, grades or marks of coursework, quizzes and exams. Since COVID era, research has highlight how meaningful integration of digital educational technology can support achievement, especially when it enhances interactivity, feedback and personalization (Cheung & Slavin, 2013; Gupta et al., 2025). Studies show that students with higher academic self-efficacy and motivation achieve better outcomes (Manas, 2023; Muratbekova, 2025). Adapting to new educational paradigms and fostering motivation are essential in improving academic outcomes in the 21st century.

The proposed framework shows how Perceived Usefulness and Perceived Ease of Use can have an impact on Academic Achievement. Using SEM SmartPLS, this study empirically tests the effects of PU and PEOU on Motivation and the indirect effects on Academic Achievement being mediated by Motivation (Figure 1).

Fig. 1. Conceptual framework.




Source: Prepared by authors

Based on the conceptual framework and the supporting literature, five hypotheses have been decided on:

H1: There is a significant positive effect of Perceived Usefulness on Motivation

H2: There is a significant positive effect of Perceived Ease of Use on Motivation

H3: There is a significant positive effect of Motivation on Academic Achievement

H4: There is a mediating effect of Motivation between Perceived Usefulness and Academic Achievement

H5: There is a mediating effect of Motivation between Perceived Ease of Use and Academic Achievement.

## MATERIALS AND METHODS

A quantitative, cross-sectional approach is used for the research design. A structured questionnaire was distributed online to participants who have adopted educational technologies in their learning processes. SMARTPLS software was used for data analysis to test the hypotheses. Ethical approval was obtained, and participation was voluntary and anonymous.

A structured, self-administered questionnaire consisting of four main constructs were used. The constructs are Perceived Usefulness, Perceived Ease of Use, Motivation and Academic Achievement. Items for PU and PEOU were adapted from the original TAM by Davis (1989), with minor contextual modifications to suit the educational setting. Motivation was measured using items based on SDT framework focusing on intrinsic and extrinsic motivation. Academic Achievement was assessed using self-reported CGPA which is commonly used indicator in educational research. All items were rated on a five point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). A pilot study had been conducted with a small group of students to ensure clarity and reliability of the questionnaire items.

Data were collected through an online questionnaire distributed to undergraduate students who have adopted educational technology in their learning. The survey, developed using validated scales, was administered via Google Forms. Participants were recruited through university mailing lists and online academic groups. Data collection took place more than six months. Prior to participation, respondents were informed about the research objectives and provided informed consent. Participants was voluntary and anonymity was assured. Out of approximately 300 being invited to participate, 257 valid responses were obtained. This has yielded a high response rate suitable for structural equation modelling analysis.

The demographic data of the respondents in this study includes gender, technology usage and CGPA. Gender is categorized into male and female respondents. Technology is classified based on how frequently students engage with technology in academic settings with categories ranging from low, medium to high usage. Lastly, CGPA is used as a measure of academic achievement to capture their overall performance. These demographic factors provide insights into how gender, technology usage and academic achievement might interact with one another (Table 1).

Table 1. Demographic.

| Demographic Factor | Category |
|---|---|
| Gender | Male |
| | Female |
| Technology Usage | Low (Occasional Use) |
| | Medium (Frequent use) |
| | High (Daily/Heavy use) |
| CGPA | |
| | 0.0-1.0 |
| | 1.1-2.0 |
| | 2.1-3.0 |
| | 3.1-4.0 |

Source: Prepared by authors

## RESULTS AND DISCUSSION

The data were collected and analyzed using PLS-SEM version 4. This method was selected due to its suitability in analyzing complex models involving latent variables and its ability to test mediating effects. The analysis followed a two-step approach: First, the measurement model was assessed to evaluate the reliability and validity of the constructs through composite reliability, Cronbach's alpha, and average variance extracted (AVE). Secondly, the structural model was examined to test the hypothesized relationship between the constructs. The mediating effect of motivation between the independent variables of PU and PEOU, and the dependent variable of academic achievement was also tested using indirect effect analysis.

### Descriptive Statistics

Descriptive statistics were calculated for the four constructs in this study: PU, PEOU, Motivation and Academic Achievement. These statistics provide an overview of the central tendency and distribution of the respondents' responses. Table 2 summarizes the mean, standard deviation, minimum and maximum values for each construct.

The findings (Table 2) indicated that the respondents reported moderate levels of PU (M=3.19, SD=0.73) and PEOU (M=3.16, SD=0.73). These denoted that undergraduates generally found the educational technologies to be reasonably useful and easy to use for academic purposes. Motivation, however, recorded a slightly higher mean (M=3.24, SD=0.69) with a wider response range (1.00 to 5.00). This reflected the variation in their internal drive and engagement

in academic tasks. Academic achievement had a mean score of 3.18 (SD=0.45). The responses ranged from 2.00 to 4.00. This indicates a more clustered perception of their academic achievement.

Table 2. Descriptive Statistics.

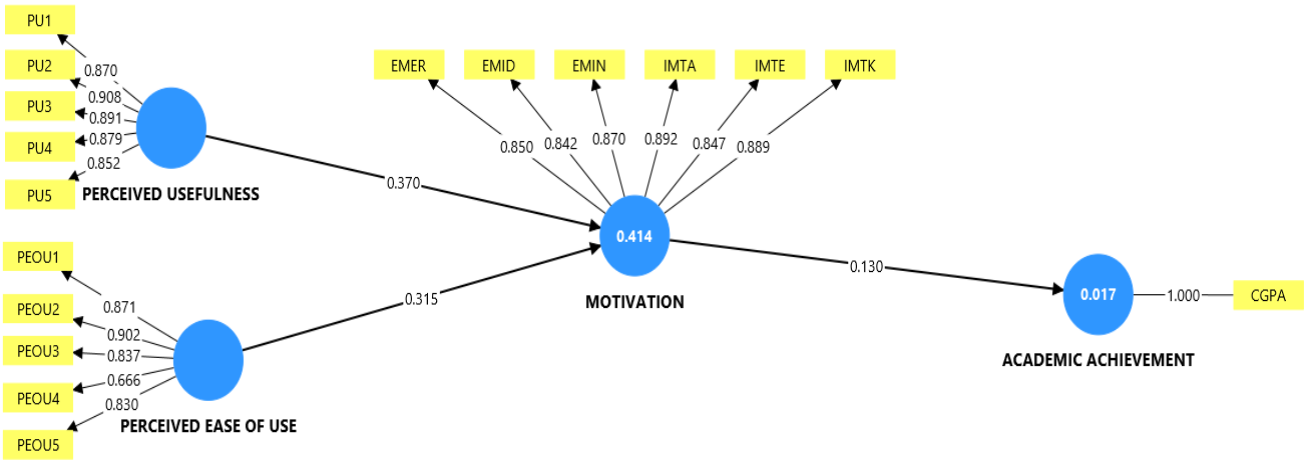
| Construct | Mean | SD | Min | Max |
|---|---|---|---|---|
| Perceived Usefulness | 3.19 | 0.73 | 1.00 | 4.00 |
| Perceived Ease of Use | 3.16 | 0.73 | 1.00 | 4.00 |
| Motivation | 3.24 | 0.69 | 1.00 | 5.00 |
| Academic Achievement | 3.18 | 0.45 | 2.00 | 4.00 |

Source: Prepared by authors

**Measurement Model**

The measurement model (Figure 2) was evaluated to ensure the constructs met the criteria for reliability, convergent validity and discriminant validity. All indicators showed acceptable factor loadings of more than 0.70. This indicates that the variables adequately represent their latent construct. According to Heir et al. (2021), factor loading should ideally be 0.70 or higher to demonstrate that the construct explains more than 50% of the indicator's variance (since $0.70^2 = 0.49$). Loadings between 0.40 and 0.70 can be acceptable if removing the items does not increase the composite reliability or if the indicator is theoretically important.

Fig. 2. Measurement Model.




Source: Prepared by authors

Table 3. Cronbach's alpha, Composite Reliability, AVE.

| | Cronbach's alpha | Composite reliability (rho_a) | Composite reliability (rho_c) | Average variance extracted (AVE) |
|---|---|---|---|---|
| Perceived Usefulness | 0.927 | 0.928 | 0.945 | 0.775 |
| Perceived Ease of Use | 0.879 | 0.885 | 0.913 | 0.681 |
| Motivation | 0.933 | 0.935 | 0.947 | 0.749 |

Source: Prepared by authors

Table 3 shows that Cronbach's Alpha and Composite Reliability were used to assess internal consistency. The internal consistency reliability for Perceived Usefulness was excellent as indicated by a Cronbach's Alpha of 0.927 and a Composite Reliability(rho_c) of 0.945. Both are well above the recommended threshold of 0.7 (Hair et al., 2021). The Composite Reliability (rho_a) was similarly high at 0.928. This confirmed the consistency of the measurements.

Furthermore, the AVE was 0.775 which exceeded the 0.5 threshold and indicated strong convergent validity. This has shown that the items measuring Perceived Usefulness consistently represent the construct and capture a large proportion of the variance.

For Perceived Ease of Use, the Cronbach's Alpha was at 0.879, and the Composite Reliability (rho_c) was 0.913. Both demonstrated good internal consistency reliability. The rho_a value was strong at 0.885 which further supported the reliability of the construct. The AVE was at 0.681 which was well above the minimum acceptable value of 0.5. These results confirm that the construct's indicators are reliably measuring the intended concept and that a substantial amount of variance is shared between the items and the latent construct.

Motivation demonstrated an exceptional high level of internal consistency with Cronbach's Alpha of 0.933 and a Composite Reliability (rho_a) was similarly high at 0.935. The AVE for Motivation was 0.749 and still exceeds the 0.5 threshold. This suggests acceptable convergent validity. Hence, the construct effectively captures the underlying concept of Motivation with high reliability. In short, all constructs exceeded the recommended threshold of 0.70; Therefore, the satisfactory internal reliability is confirmed. All AVE values exceeded the 0.50 threshold. This means that the constructs explain more than 50% of the variance in their indicators. Thus, the convergent validity was established.

Table 4. Fornell-Larcker Criterion.

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1- Academic Achievement | 1.000 | | | |
| 2- Motivation | 0.130 | 0.865 | | |
| 3- Ease of Use | 0.159 | 0.597 | 0.825 | |
| 4- Perceived Usefulness | 0.089 | 0.610 | 0.764 | 0.880 |

Source: Prepared by authors

Table 4 shows that discriminant validity was examined using Fornell-Larcker criterion. According to Fornell-Larcker (1981) criterion, the square root of each construct's AVE (the diagonal values) should be greater than the off-diagonal correlations with other constructs. The value for Academic Achievement on the diagonal is 1. This is higher than its correlation with Motivation (0.130), Perceived Ease off Use (0.159) and Perceived Usefulness (0.089). Therefore, Academic Achievement shows good discriminant validity. The square root of AVE for Motivation is 0.865, and it is higher than its correlations with Academic Achievement (0.130,) Perceived Ease of Use (0.597) and Perceived Usefulness (0.610). Thus, Motivation also demonstrates good discriminant validity. The square root of AVE for Perceived Ease of Use is 0.825, and it is higher than its correlations with Academic Achievement (0.159), Motivation (0.597), and Perceived Usefulness (0.764). Perceived Ease of Use satisfies the discriminant validity requirement. The square root of AVE for Perceived Usefulness is 0.880 which is greater than its correlations with Academic Achievement (0.089), Motivation (0.610) and Perceived Ease of Use (0.764). Hence, Perceived Usefulness also meets the discriminant validity criterion. Since the diagonal values for all constructs are larger than the correlations with other constructs, discriminant validity is established according to the Fornell- Larcker criterion.

Table 5. HTMT Ratios.

| | 1 | 2 | 3 | 4 |
|---|---|---|---|---|
| 1-Academic Achievement | | | | |
| 2-Motivation | 0.133 | | | |
| 3-Perceived Ease of Use | 0.170 | 0.658 | | |
| 4-Perceived Usefulness | 0.093 | 0.652 | 0.843 | |

Source: Prepared by authors



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Besides using Fornell Larcker Criterion, the discriminant validity of the constructs was assessed using the Heterotrait-Monotrait Ratio (HTMT) (Table 5) as recommended by Henseler et at. (2015). All HTMT values were found to be below the recommended threshold of 0.90 which confirmed the satisfactory discriminant validity of among the constructs. Specifically, the HTMT values between Academic Achievement and Motivation (0.133) Academic Achievement and Perceived Ease of Use (0.170), and Academic Achievement and Perceived Usefulness (0.093) were substantially lower than the threshold. Similarly, Motivation showed acceptable discriminant validity with both Perceived Ease of Use (0.658) and Perceived Usefulness (0.652). Although the HTMT value between Perceived Ease of Use and Perceived Usefulness (0.843) was relatively higher, it remained within acceptable limits. Thus, it can be concluded that all constructs exhibit distinctiveness from one another in the model.

**Structural Model**

The structural model assessment evaluates the hypothesized relationship between the latent variables. In structural equation modelling, effects of 0.1 are small, 0.3 are moderate and above 0.5 are strong.

Table 6. Direct Relationship.

| | Original sample (O) | Sample mean (M) | Standard deviation (STDEV) | T statistics (\|O/STDEV\|) | P values |
|---|---|---|---|---|---|
| H1. PU -> MOT | 0.372 | 0.37 | 0.083 | 4.472 | 0 |
| H2. PEOU -> MOT | 0.319 | 0.326 | 0.088 | 3.615 | 0 |
| H3. MOT -> CGPA | 0.133 | 0.134 | 0.065 | 2.06 | 0.04 |

Source: Prepared by authors

H1 (PU→MOT):

Perceived Usefulness has a positive and significant (Table 6) effect on Motivation ($\beta$=0.372, $p<0.001$). This shows that when undergraduates find technology useful, their motivation increases.

H2 (PEOU→MOT):

Perceived Ease of Use has a positive and significant effect on Motivation ($\beta$=0.319, $p<0.001$). This confirms that when undergraduates find the technology is easy to use, they feel more motivated.

H3 (MOT→CGPA)

Motivation has a significant but smaller effect on Academic Achievement ($\beta$=0.133, $p<0.040$). This suggests that Motivation does play a role in improving Academic Achievement although the size of the effect is modest. In other words, Motivation slightly improves Academic Achievement.

The largest total effect is from PU to Motivation. It shows that PU plays a stronger role in enhancing motivation than PEOU. All these paths are statistically significant ($p<0.05$); therefore, H1, H2 and H3 support the conceptual model.

Table 7. Mediation Relationship.

| | Total Effect | | | Indirect Effects | |
|---|---|---|---|---|---|
| | Coefficient | p-value | | Coefficient | p-value |
| PU -> CGPA | 0.05 | 0 | H4. PU -> M -> CGPA | 0.05 | 0 |
| PEOU -> CGPA | 0.042 | 0 | H5. PEOU -> M -> CGPA | 0.042 | 0 |

Source: Prepared by authors

The total effect refers to the overall impact that an independent variable (PU or PEOU) has on a dependent variable (CGPA). This includes both direct and indirect influences. In this study, both Perceived Usefulness (PU) and Perceived Ease of Use (PEOU) have positive and significant total effects on Academic Achievement (CGPA) with p values of 0 (Table 7). This indicates a very strong statistical significance and confirms that these relationships are statistically

robust. Subsequently, the total effect of PU on CGPA is significant (β=0.050, p=0.000). Also, the total effect of PEOU on CGPA is significant (β=0.042, p=0.000).

A mediation analysis was conducted to examine whether or not Motivation mediates the relationship between the independent variables (PU and PEOU) and the dependent variable (CGPA). Table 7 shows that Motivation plays a significant mediating role. For Hypothesis 4 (PU→MOT→CGPA), the indirect effect was statistically significant (β=0.05, p=0.000). Hypothesis 5 (PEOU→MOT→CGPA) is also supported as the value of indirect effect is β=0.042, p=0.000. This confirms the mediating role of Motivation and supports the H4 where Motivation mediates the relationship between Perceived Usefulness and Academic Achievement, and H5 where Motivation mediates the relationship between Perceived Ease of Use and Academic Achievement.

These findings indicate that when undergraduates perceive technology as useful or easy to use, they become more motivated. This eventually contributes to higher academic achievement. As Perceived Usefulness has significant positive effect on Motivation, it aligns with the Technology Acceptance Model that postulates that users are more likely to adopt and be engaged with a system if they believe it enhances their performance (Davis, 1989). In this context, undergraduates who perceive technology as helpful for their academic tasks are highly likely to feel motivated to use it consistently. This relationship is also clearly supported by Self Determination Theory (SDT) that emphasizes that when individuals perceive a tool as useful, they are prone to develop intrinsic motivation (Deci & Ryan, 2000). The strong effect size indicates that Perceived Usefulness is a key motivational driver in academic contexts where technology is integrated.

Similarly, Perceived Ease of Use (PEOU) significantly predicts motivation. According to TAM, if students find technology to be intuitive and simple, they are more likely to use it without resistance, thereby maintaining or increasing their motivation to engage with academic tasks.

Furthermore, Intrinsic Motivation especially has been shown to directly impact learning outcomes and academic achievement (Pintrich & Schunk, 2002). This authenticates that psychological engagement plays a crucial role in achieving high academic standards. This study is again aligned with SDT that emphasizing when students feel motivated, they are more likely to exert effort and perform better (Deci & Ryan, 1985). While the coefficient is smaller than for H1 and H2, its statistical significance underscores that motivation is a meaningful bridge between technological perception and academic achievement.

Interestingly, the total effects of PU and PEOU on CGPA are equal to their respective indirect effects which led to full mediation. These findings highlight the psychological mechanism through which technological perception translates into achievement. In other words, technology that is perceived as useful and easy to use can only improve academic outcomes when it also enhances motivation of the undergraduate. Together, the hypotheses (HI to H5) reinforce the importance of a mediated model: the perception of technology's usefulness and ease of use is not enough on its own to better academic outcomes. Instead, these perceptions must first ignite motivation which then propels academic achievement. This highlights the essential role of psychological engagement in realizing the academic benefits of technology.

## CONCLUSIONS

Based on the findings, it is clear that effective technology adoption plays a significant role in enhancing academic outcomes of undergraduates particularly when they perceive digital tools as useful and easy to use. Therefore, educational institutions and developers should prioritize the design and implementation of technology that aligns with users' learning needs and preferences. Tools should be intuitive and seamlessly integrated into academic tasks and at the same time capable of supporting meaningful learning experiences. Besides that, educators should be equipped with training to encourage the use of such technologies in ways that actively support learners' engagement and achievement.

Future research should further explore how different types of technologies influence learning outcomes across disciplines and student populations. Moreover, policymakers and higher learning institutions should consider long term strategies for promoting technology adoption, such as investing in infrastructure, digital literacy programs and continues support systems to ensure that both undergraduates and educators can maximize the benefits of educational technologies. Most importantly, educators are the main players and the key role in this process of fostering motivation through relevant content, positive reinforcement and supportive learning environments.

It is equally important for future research to investigate different forms of motivation and to explore how these dynamics operate across diverse undergraduate groups and educational contexts. Lastly, higher learning institutions and policymakers should recognize that meaningful investment in motivation of undergraduate through strategies like mentorship, timely feedback and emotionally supportive academic environments can significantly amplify the effectiveness of technology in promoting academic achievement.

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