Impact of Perceived Usefulness and Ease of Use on Behavioural Intention to Use Excel Templates in Education: The Mediating Role of Attitude

Maryam Jameelah Mohd Hashim[*1], Mohd Rahim Khamis and Idris Osman[2]

[1]Department of Economics and Finance Studies, Faculty of Business Management, University Teknologi MARA, Selangor Branch Malaysia

[2]Department of Human Resource Management, Faculty of Business Management, University Teknologi MARA, Melaka Branch

[*]Corresponding Author

DOI: https://dx.doi.org/10.47772/IJRISS.2025.908000534

Received: 14 August 2025; Accepted: 20 August 2025; Published: 19 September 2025

ABSTRACT

This study examines the relationships between perceived usefulness, perceived ease of use, and behavioural intention to use Excel templates in education, with a focus on the mediating role of attitude. Data were collected from 221 third- and fourth-semester Finance undergraduates at UiTM Puncak Alam using purposive sampling and analysed via Partial Least Squares Structural Equation Modelling (PLS-SEM). Results show that perceived usefulness (PU) and perceived ease of use (PEU) significantly influence behavioural intention, with attitude fully mediating these relationships. Findings highlight that when students perceive Excel as both user-friendly and beneficial, their intention to use it strengthens. Practical implications include designing workshops that improve students' perceptions of Excel templates, thereby fostering positive attitudes and greater adoption. The study contributes theoretical insights to TAM research while offering practical and pedagogical recommendations for integrating digital tools in education.

Keywords: Perceived usefulness, Ease of use, Behavioural intention, Attitude, PLS-SEM

JEL Classification Number: A22, O33

INTRODUCTION

These days, it is hard to find a classroom that does not have some kind of digital device next to a student's notebook for a week. Spreadsheets, especially Excel, have silently pushed their way into that picture, and they are now much more than just grids for shopping budgeting (Barreto, 2015). When people type in their estimations, the program produces neat rows and columns with trend lines, monetary values, and even a few Monte Carlo simulations (Neurath & Stephens, 2006; Vidmar, 2007). The sight can turn a shaky guess into a verifiable numerical frame nearly before the coffee cools (Visconti, 2012). However, none of that power will work unless teachers and students first agree that the tool is worth keeping (Song et al., 2023).

The reluctance of most educators and students to initiate Excel and search for a pre-existing template is central to the issue addressed by this study (Murni et al., 2020). A well-built worksheet can save an afternoon and turn numerical drudgery into something almost pleasant, so the mystery is why the files remain dormant in so many course folders. Typical explanations point to habit, training gaps, or plain inertia, but few studies have moved beyond speculation to measure specific attitudes. Early work grounded in Davis's Technology Acceptance Model (TAM) warned that user beliefs about usefulness and ease of use accompany any new

system long before the manual pages are read (Webb, 1987). Columns of numbers appear on screens differently when instructors gamify the drill, and recent classroom pilots have tested that idea using active serious game techniques (Rodríguez-Calzada et al., 2024). Yet student sentiment about mathematics itself muddies the waters—some learners label the subject tedious, others call it unfairly difficult, and a few ranks it among their greatest achievements (Jutin & Maat, 2024).

The arrival of digital tools in the classroom has fundamentally altered everyday pedagogy, opening unexpected pathways for student involvement and for grasping tricky ideas. Customizable spreadsheet templates serve a wide range of classroom tasks, from maintaining grade books to monitoring individual progress and generating end-of-term reports (Alfozan & Kadampur, 2021). Engineering educators, in particular, have found that tools such as Microsoft Excel can deepen student understanding when the software is woven thoughtfully into hands-on exercises (Zhang et al., 2021). Although more powerful applications exist, the popularity of Excel makes it the focal point of this study; data created in most programs can usually be imported to or exported from Excel without difficulty (Visconti, 2012). Even the most carefully designed template will fall short if instructors and students doubt its usefulness or see it as cumbersome. Core mathematical principles underlie the statistical routines built into spreadsheet platforms, and a solid grasp of those principles is essential for meaningful application (Divisi et al., 2017). The goal of this study is to identify the impact of perceived usefulness and ease of use on students' behavioural intention to use Excel templates in education and whether a student's attitude acts as a mediator, connecting the two perceptions to the behaviour in question.

LITERATURE REVIEW AND HYPOTHESIS DEVELOPMENT

Behavioural intention is frequently oversimplified as mere desire; nevertheless, researchers recognise it as the deliberate choice to engage in or abstain from a certain action (Aditia et al., 2018). This debate, positioned between attitude and action, provides researchers with a clearer understanding of students' actual behaviours. Behavioural intention serves as a proximal predictor that connects beliefs, desires, and observable behaviour (Tran & Vu, 2025). Behavioural intention reflects students' inclination to utilise or refrain from utilising an Excel template. It assesses the preparedness of students to incorporate a spreadsheet into assignments. The Technology Acceptance Model reduces these evaluations to perceived usefulness and perceived ease of use, toward attitudes that influence intention (Venkatesh & Bala, 2008). Recent research supports this succinct perspective, identifying the same two elements as primary contributors to the adoption conundrum (Palumian et al., 2021).

Research indicates that the strength of an individual's expressed intention to utilise Excel templates consistently forecasts the frequency of their actual application. Behavioural intention is not independent; it is influenced by various factors, including perceived usefulness, perceived ease of use, personal attitude, existing social norms, and the availability of supportive resources (Abbad, 2021). Recent evidence indicates that evaluations of perceived usefulness and ease of use have both direct and indirect influences on intention (Wu et al., 2024). When students perceive the templates as genuinely useful and easy to use, their disposition becomes more favourable, which then enhances their intent, creating a cyclical return to practical application.

Perceived Usefulness and Its Influence on Behavioural Intention

Perceived usefulness is a fundamental aspect of technology acceptance studies, elucidating the reasons individuals, particularly university students, opt to utilise a specific instrument. Satisfaction increases when an Excel template is perceived not just as a blank canvas but as a valuable tool that alleviates the mental burden of repetitive calculations. Price et. al (2019) note that this perception of worth frequently solidifies instantaneously when the student perceives an integrated pivot chart that transforms raw attendance data into an easily comprehensible visual format. The identical heuristic drive propels the PhD student racing against a deadline, indicating that emotional perceptions can override rigorous intellectual analysis. Extensive literature on LMS portals and mobile quiz applications indicates that numerous surveys reveal students are inclined to consistently engage in next-day logins if they perceive the system will enhance their professional acumen or conserve valuable time. Fearnley et al. (2020) substantiate the assertion by compiling data from their cohorts

of engineers, nurses, and fine-art students, who identify analogous motivators irrespective of academic terminology. Excel templates discreetly include features such as automated subtotalling, drag-and-drop charts, and colour-coordinated dashboards, thus attaining the coveted designation of usefulness prior to the commencement of the initial lecture. Initial assessments of first-year business students indicate a troubling trend: they frequently struggle with fundamental spreadsheet tasks, highlighting a persistent need for practical tutoring (Lantushenko et al., 2018). Simultaneously, the internet has evolved into an extensive repository of concise videos and detailed tutorials, many of which highlight the compatibility of standard Excel templates with diverse classroom practices (Jaiswal, 2020). Educators utilise these files to create dynamic gradebooks, swiftly check attendance, and identify grade patterns with minimal effort. Students thereafter compile research data, perform rapid statistical analyses, and refine presentation charts once the template is accessible. Therefore, the hypothesis:

H1: Perceived usefulness significantly influences Behavioural Intention

Perceived Ease of Use and Its Influence on Behavioural Intention

Perceived ease of use refers to the degree to which a user perceives that a particular technology requires minimal physical or cognitive effort. When educators and learners encounter Excel templates that are easily comprehensible without extensive tutorials, their subsequent endorsement of the tool encourages their expressed plans for regular use. The perception of simplicity is rarely coincidental; it arises from an organised interface, readily available assistance documentation, and a minimal requirement of fundamental technical proficiency. Kešelj et al. (2025) note that usability aspects subtly affect perceptions of e-learning systems and thus impact final learning outcomes. A platform that exhibits predictable behaviour, supports regular routines, and makes its essential functionalities readily accessible is likely to attract more users (Le, 2021). The concept also connects with associated topics such as perceived complexity, learnability, and user autonomy. Applications that appear complex, necessitate extensive training, or have few options for user customisation often fail to thrive, despite their potentially robust features. Perceived ease of use, as described by Mashabela and Kekwaletswe (2020), refers to the conviction that a software application will require minimal human effort. Excel templates are frequently influenced by explicit step-by-step instructions, an intuitive design, and customisable features to accommodate personal preferences. When developers focus on these features, they provide a resource that appears manageable instead of daunting. Practical enhancements—pop-up tooltips, concise screencast lectures, and prototype files integrated with cues—alleviate cognitive burden and facilitate rapid user orientation. In the absence of meticulous design consideration, even the most robust template may be relegated to obsolescence due to frustration. Palumian et al. (2021) assert that enhancing perceived ease of use is essential for the widespread adoption of Excel templates by schools and instructors, thereby realising their full potential for academic purposes. Therefore, the hypothesis:

H2: Perceived ease of use significantly influences Behavioural Intention

Attitude as a Mediating Factor Influencing Behavioural Intention

Although perceived usefulness and perceived ease of use are primary determinants of behavioural intention, various other factors may mediate or mitigate their impact. The attitude towards behaviour is influenced by both perceived ease of use and perceived usefulness (Zaineldeen et al., 2020). Educators with sufficient resources are more inclined to utilise Excel templates than those without such support. The attitude towards technology significantly influences behavioural intentions, serving as a mediator between views about the technology and the decision to embrace it (Ibrahim et al., 2025). The Technology Acceptance Model posits that attitudes about technology usage impact behavioural intention, subsequently influencing actual technology utilisation (Ibrahim et al., 2025). The model emphasises user-friendliness and utility in the design of information technology (Karnsomdee, 2025). Perceptions of technology are shaped by its perceived usefulness and perceived ease of use, which in turn impact the desire to utilise the technology (Usman et al., 2021). Despite the Technology Acceptance Model's impact, the mediating function of attitude in forecasting technology adoption has been variable, prompting some scholars to scrutinise its relevance (Kim et al., 2009).

Attitude serves as a vital connection between an individual's opinions regarding a technology and their ensuing intention to use it (Trenerry et al., 2021). The greater the ease of use of a technology, the higher the likelihood of its adoption, as individuals inherently favour innovations that require minimal work or time (Shahzad et al., 2024). A positive attitude towards technology indicates a favourable disposition that enhances the possibility of adoption, whereas a negative attitude denotes resistance that impedes adoption. Therefore, the hypothesis:

H3: Attitude significantly mediates the relationship between Perceived Usefulness and Behavioural Intention

H4: Attitude significantly mediates the relationship between Perceived Ease of Use and Behavioural Intention

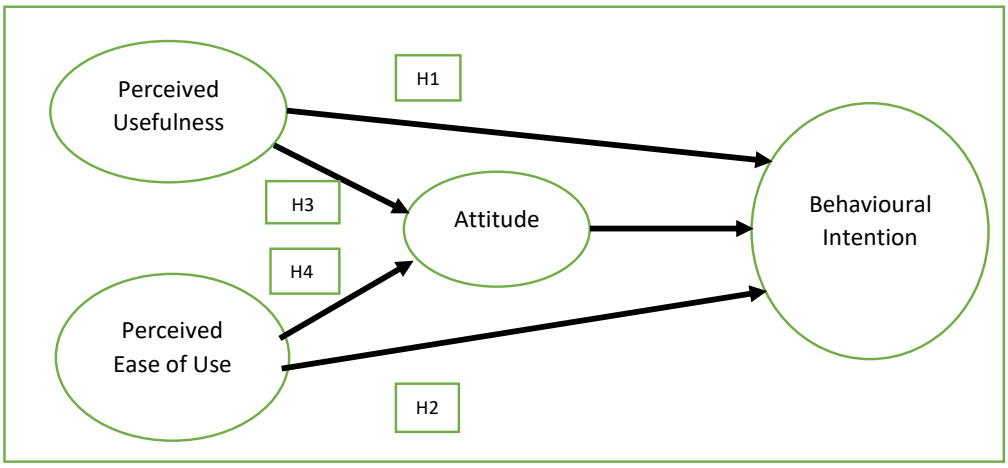

Figure 1: Research Framework

METHODOLOGY

This quantitative study targeted Semester 3 and 4 Finance students at UiTM Puncak Alam, chosen purposively because they are regularly exposed to Excel in core coursework, making them an appropriate group for studying adoption behaviour. Data were collected through a structured 20-item questionnaire measured on a 5-point Likert scale with 1 representing "strongly disagree" and 5 indicating "strongly agree". Purposive sampling was employed to ensure respondents met the criteria of having prior exposure to Excel templates in their courses. Questionnaire items were adapted from established sources (Davis, 1989; Venkatesh & Davis, 2000; Ajzen, 1991), and validity was ensured through expert review and pilot testing. Following Hair et al. (2021), G*Power confirmed a minimum required sample size of 107; 221 valid responses were analysed using SmartPLS 4.1.1.2. Table 1 presents data regarding the constructs, items, and their respective sources. This study utilised a cross-sectional survey methodology, as indicated by Sekaran and Bougie (2016). The data gathered for this research were collected from October to December 2024.

Table 1: Constructs, items, and sources

Constructs	**Items**	**Sources**
Perceived Usefulness	5 items	Davis (1989)
Perceived Ease of Use	6 items	Davis (1989)
Attitude	5 items	Venkatesh & Davis (2000)
Behavioural Intention to Use	4 items	Ajzen (1991)

Sources: Davis (1989), Venkatesh & Davis (2000), Ajzen (1991)

Researchers generally evaluate the measurement model by computing the heterotrait-monotrait ratio, verifying composite reliability, and assessing outer loadings; furthermore, multicollinearity issues are frequently

mitigated using variance inflation factors (see Hair et al., 2021; Shmueli et al., 2019; Hair et al., 2017). In contrast, structural model diagnostics often emphasize t-values and p-values, while also presenting the coefficient of determination (R^2) and the breadth of its confidence range.

EMPIRICAL RESULTS

The results of the descriptive analysis, presented in Table 2, indicate that 115 students (52%) reported being in semester 3, whereas 106 students (48%) studied in semester 4. Furthermore, out of the total respondents, 91 students (41%) identified as male, while the remaining students (59%) identified as female.

Table 2: Demographic Profile

Semester	**Total**	**%**
Semester 3	115	52
Semester 4	106	48
Gender		
Male	91	41
Female	130	59

Partial Least Square – Structural Equation Modelling (Measurement Model)

Researchers regularly examine model inventories for missing items, highlighting item loadings and calculating composite reliability together with the average variance extracted. Table 3 demonstrates that each indicator cluster in the TAM sub-scales is around 0.7 to 0.8. The conversation then turns to stress relevance, which is a testing stage that determines which variables will remain in the framework. Average variance extracted and composite reliability values are both still above the 0.60 cut-off. Thus, they are retained. Hulland (1999) suggested eliminating items that fall below the 0.5 minimum. A second look at the individual loadings shows that none of them fall below 0.738, which suggests strong internal resonance across all five reflective domains. The reliability coefficients also support this: perceived usefulness is 0.939, perceived ease of use is 0.928, attitude is 0.939, and behavioural intention is close to 0.912. Hair et al. (2021) state that anything over 0.60 should be considered consistent. Therefore, the scales easily meet that standard. According to Ramayah et al. (2018), convergent validity requires average variance extracted figures to be more than 0.5. This study affirms that every latent construct passes that criterion, with procedural barriers having the highest AVE of 0.755.

Table 3: Discriminant Validity

	Loading	**CR**	**AVE**
Perceived Usefulness		0.939	0.754
PU1	0.852		
PU2	0.889		
PU3	0.896		
PU4	0.868		
PU5	0.834		
Perceived Ease of Use		0.928	0.684
PEU1	0.774		
PEU2	0.832		
PEU3	0.738		
PEU4	0.877		
PEU5	0.875		
PEU6	0.856		

Attitude		0.939	0.755
ATT1	0.869		
ATT2	0.897		
ATT3	0.886		
ATT4	0.802		
ATT5	0.889		
Behavioural Intention		0.912	0.722
INT1	0.848		
INT2	0.816		
INT3	0.868		
INT4	0.866		

Note: Average Variance Extracted (AVE), Composite reliability (CR)

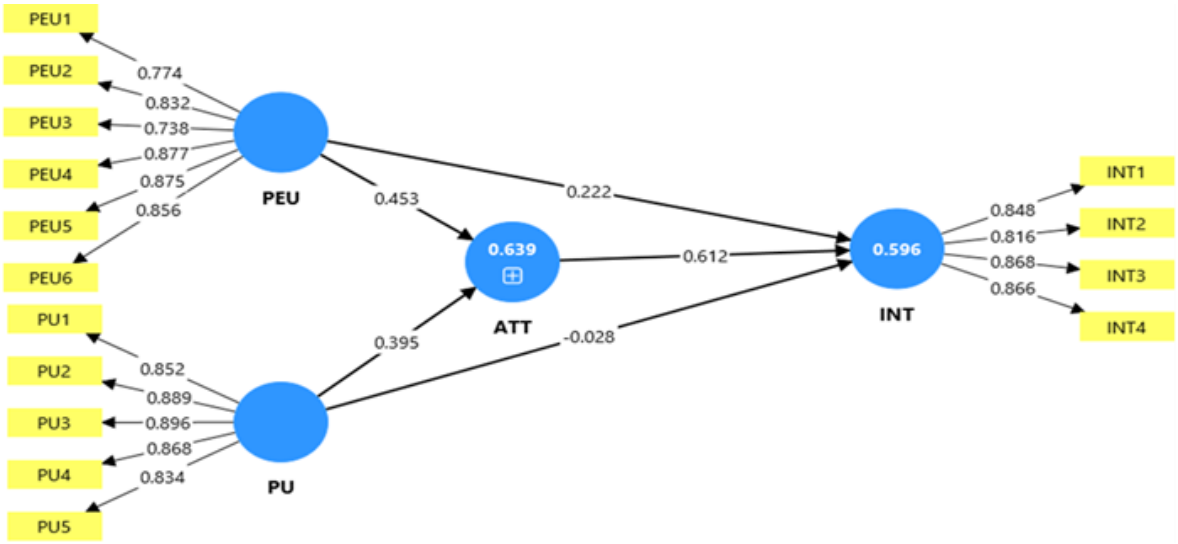

Figure 2: Measurement Model

Figure 2 shows that all four components were latent constructs. As Henseler, Ringle, and Sarstedt (2015) suggested, this analysis used the HTMT to assess discriminant validity. Henseler et al. (2015) define discriminant validity as a construct correlation below one. However, Kline's (2012) stricter criterion of 0.85 was used to distinguish the constructs more effectively. The correlation estimates for HTMT scores appear in Table 4.

Table 4: Heterotrait-Monotrait (HTMT)

	ATT	INT	PEU	PU
ATT				
INT	0.840			
PEU	0.829	0.744		
PU	0.810	0.664	0.853	

In this study, the VIF values for all predictor variables were well below the commonly accepted threshold of 4, and even further from the more stringent cut-off of 3.3, indicating that multicollinearity is not a significant concern in this model (Matsukawa et al., 2023). Examining the individual VIF values for each predictor variable provides a granular perspective on the potential for multicollinearity. Perceived Usefulness recorded a VIF of 2.978, Perceived Ease of Use registered a VIF of 3.115, and Attitude exhibited a VIF of 2.770. These

ISSN No. 2454-6186 | DOI: 10.47772/IJRISS | Volume IX Issue VIII August 2025

figures suggest that while there is some correlation among the predictor variables, it is not strong enough to cause substantial multicollinearity issues (Kim, 2019). The VIF is displayed in Table 5.

Table 5: Variance Inflation Factor

Construct	VIF
ATT	2.770
PEU	3.115
PU	2.978

Source: Own source (Smart PLS)

Partial Least Square – Structural Equation Modelling (Structural Model)

Smart PLS bootstrapping elucidates the concealed relationships among latent constructs when researchers evaluate their structural model. The coefficients for each path, along with their respective t-values, convey the narrative. This diagnostic framework is firmly situated within the broader domain of Structural Equation Modelling and reflects a tradition initially delineated by Hair et al. (2021).

Table 6: Path Coefficient and Hypothesis Testing

Direct Effect						
Hypothesis	**Relationship**	**Path**	**T statistics**	**P values**	**CI LL**	**CI UL**
H1	PU → INT	0.214	2.356	0.019	0.037	0.393
H2	PEU → INT	0.499	5.414	0.001	0.319	0.679
Indirect Effect						
Hypothesis	**Relationship**	**Path**	**T statistics**	**P values**	**CI LL**	**CI UL**
H3	PU →ATT → INT	0.242	3.412	0.001	0.119	0.393
H4	PEU → ATT → INT	0.277	4.194	0.001	0.149	0.409

Source: Own source (Smart PLS)

The structural analysis in Table 5 shows that PU and PEU have a direct effect on behavioural intention to use. The data suggest a significant link between PU and INT, and PEU and INT, as shown by H1 ($\beta = 0.214$, $p < 0.019$) and H2 ($\beta = 0.499$, $p < 0.01$). Perceived Usefulness and Perceived Ease of Use significantly affect a user's attitude toward a system, which in turn determines whether the user will have the intention to use the system (Bryan & Zuva, 2021). Moreover, Perceived Usefulness and Perceived Ease of Use have significant positive effects on Behavioural Intention to Use (Prasetyo et al., 2021). This aligns with TAM, suggesting that both usefulness and ease of use directly impact the intention to adopt the technology. The Technology Acceptance Model posits that an individual's intention to use a particular technology is determined by two primary beliefs: perceived usefulness, which reflects the extent to which a person believes that using the technology will enhance their job performance, and perceived ease of use, which indicates the degree to which a person believes that using the technology will be free of effort (Venkatesh & Bala, 2008; Zaineldeen et al., 2020).

Furthermore, a significant correlation on the indirect effect of ATT as a mediator towards the relationship between PU and INT, and PEU and INT is shown by the statistical analysis of H3 ($\beta = 0.242$, $p < 0.01$) and H4 ($\beta = 0.277$, $p < 0.01$). Perceived Usefulness and Perceived Ease of Use significantly affect a user's attitude toward a system, which in turn determines whether the user will have the intention to use the system (Bryan & Zuva, 2021). In the context of Excel templates, students' attitudes are influenced by their perceptions of the template's usefulness in streamlining tasks and its ease of use. If students perceive an Excel template as a valuable tool that saves time and improves accuracy, they are more likely to develop a positive attitude towards it. The easier a technology is to use, the more likely it is to be adopted because individuals naturally prefer

technologies that do not demand substantial effort or time (Shahzad et al., 2024). A positive attitude towards technology reflects a favourable disposition, increasing the likelihood of adoption, while a negative attitude signals resistance, hindering adoption. Moreover, attitude toward using technology plays a pivotal role in shaping behavioural intentions, acting as a mediator between beliefs about the technology and the subsequent decision to adopt it (Ibrahim et al., 2025). Hence, PU and PEU explain 63.6% of the variance in ATT, while ATT explains 59% of the variance in INT. These R-squared values indicate a substantial explanatory power of the model (Kowitlawakul, 2025).

The analysis confirms that Attitude fully mediates the relationship between both Perceived Usefulness and Perceived Ease of Use on Behavioural Intention to Use, underscoring the critical role of positive attitudes in technology adoption. This complete mediation suggests that the influence of perceived usefulness and ease of use on behavioural intention is entirely channelled through an individual's attitude, highlighting that fostering a positive attitude is paramount for encouraging the adoption of Excel templates. Previous studies suggest that users' attitudes toward a system significantly determine whether they will adopt or reject it (Bryan & Zuva, 2021). Therefore, the study reinforces the importance of creating user-friendly and useful Excel templates to cultivate positive attitudes, which in turn drive adoption. The robust findings of this study offer valuable insights into the mechanisms driving the acceptance of technology. Understanding the significant influence of perceived usefulness and perceived ease of use on attitude (Kontis & Ioannidis, 2025), along with the pivotal mediating role attitude plays in shaping behavioural intention, can guide strategic interventions aimed at promoting technology adoption in diverse settings.

SUMMARY AND CONCLUSIONS

The results of this study indicate that students' behavioral intention to utilize Excel templates is significantly affected by their judgments of both usefulness and ease of use, with attitude serving as a comprehensive mediator. This result underscores the necessity of cultivating affirmative attitudes to effectively promote technological adoption. Consistent with the Technology Acceptance Model and prior studies, including Ibrahim et al. (2025), the findings validate that evaluations of utility and usability are interconnected and collectively influence students' preparedness to incorporate technology into their learning methodologies. When students see Excel as easy to use and plainly helpful for their schoolwork, they are more likely to use it regularly instead of just sometimes.

Setälä et al. (2025) present supplementary evidence suggesting that the incorporation of compatibility variables enhances predictions of perceived usefulness, whilst enjoyment is significantly correlated with both perceived usefulness and ease of use. These results align with previous studies indicating that attitudes function as the essential connection between core beliefs and the decision to embrace a technology (Lin et al., 2025). This indicates that educators should highlight the practicality and accessibility of Excel templates to foster positive student attitudes, therefore increasing adoption rates, as noted by Baig and Yadegaridehkordi (2025). Similarly, design methodologies that customize tools to correspond with students' cognitive and behavioral inclinations have demonstrated efficacy in promoting both initial acceptance and sustained engagement.

There is now growing evidence that how teachers see things has a big effect on how students behave. When teachers tell students that Excel templates are both valuable and easy to use, students are more likely to utilize them correctly and often. This not only makes academic work more accurate and efficient, but it also makes learning results better overall. These observations collectively bolster the narrative posited by the Technology Acceptance Model: judgments of utility and user-friendliness, alongside favorable attitudes, are the cornerstone of enduring acceptance of educational technology, exemplified by Excel templates.

This study makes three important contributions. Theoretically, it enhances the Technology Acceptance Model (TAM) by asserting that attitude serves as a mediating factor in the acceptance of technology in educational contexts, hence augmenting the model's explanatory efficacy. From a practical standpoint, universities ought to contemplate the establishment of experiential workshops that not only emphasize the functional advantages

of Excel templates but also mitigate their complexity, thereby fostering more positive opinions among students. Lecturers can include Excel templates in their pedagogical practices to enhance familiarity, mitigate resistance, and promote ongoing utilization in assignments and projects, ultimately facilitating long-term integration into students' academic routines.

It is essential to acknowledge the constraints of this investigation. The dependence on self-reported, cross-sectional data engenders possible bias and may fail to accurately reflect behavioral dynamics over time. Subsequent research ought to examine longitudinal methodologies to monitor variations in adoption behavior over semesters or academic years. Furthermore, the integration of qualitative components, such as interviews or focus groups, would yield more profound insights into the intricate experiences and perceptions of students. Extending the research beyond Finance students to encompass additional disciplines and institutions would enhance the generalizability of the findings and uncover potential disparities across academic contexts.

In conclusion, this study highlights the pivotal influence of perceived usefulness, perceived ease of use, and attitude on students' propensity to adopt Excel templates. By emphasizing the interaction among these characteristics, it not only enhances theoretical frameworks through the validation of TAM but also provides practical and pedagogical approaches for promoting successful and enduring integration of educational technologies in higher education.

REFERENCES

1. Abbad, M. M. (2021). Using the UTAUT Model to Understand Students' Usage of e-Learning Systems in Developing Countries. Education and Information Technologies, 26, 7205-7224. https://doi.org/10.1007/s10639-021-10573-5
2. Aditia, E., Tela, I. N., Saleh, N., Ilona, D., & Zaitul, Z. (2018). Understanding the Behavioral Intention to Use a University Web-Portal. MATEC Web of Conferences, 248, 5004. https://doi.org/10.1051/matecconf/201824805004
3. Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T
4. Alfozan, A., & Kadampur, M. A. (2021). System Design and Case Study Reporting on AQASYS: A Web-based Academic Quality Assurance System. International Journal of Advanced Computer Science and Applications, 12(7). https://doi.org/10.14569/ijacsa.2021.0120791
5. Baig, M. I., & Yadegaridehkordi, E. (2025). Factors influencing academic staff satisfaction and continuous usage of generative artificial intelligence (GenAI) in higher education. International Journal of Educational Technology in Higher Education, 22(1). https://doi.org/10.1186/s41239-025-00506-4
6. Barreto, H. (2015). Why Excel? The Journal of Economic Education, 46(3), 300. https://doi.org/10.1080/00220485.2015.1029177
7. Bryan, J. D., & Zuva, T. (2021). A Review on TAM and TOE Framework Progression and How These Models Integrate [Review of A Review on TAM and TOE Framework Progression and How These Models Integrate]. Advances in Science Technology and Engineering Systems Journal, 6(3), 137. Advances in Science, Technology and Engineering Systems Journal (ASTESJ). https://doi.org/10.25046/aj060316
8. Davis, F. D., Bagozzi, R. P., & Warshaw, P. R. (1989). User Acceptance of Computer Technology: A Comparison of Two Theoretical Models. Management Science, 35(8), 982. https://doi.org/10.1287/mnsc.35.8.982
9. Divisi, D., Leonardo, G. D., Zaccagna, G., & Crisci, R. (2017). Basic statistics with Microsoft Excel: a review [Review of Basic statistics with Microsoft Excel: a review]. Journal of Thoracic Disease, 9(6), 1734. AME Publishing Company. https://doi.org/10.21037/jtd.2017.05.81
10. Fearnley, M. R., & Amora, J. T. (2020). Learning Management System Adoption in Higher Education Using the Extended Technology Acceptance Model. IAFOR Journal of Education, 8(2), 89. https://doi.org/10.22492/ije.8.2.05

11. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2017). Multivariate Data Analysis: A Global Perspective (7th Editio). Pearson New International Edition.
12. Hair, J. F., Hult, G. T. M., Ringle, C. M., Sarstedt, M., Danks, N. P., & Ray, S. (2021). Evaluation of the Structural Model. In Classroom companion: business (p. 115). Springer International Publishing. https://doi.org/10.1007/978-3-030-80519-7_6
13. Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. Journal of the academy of marketing science, 43, 115-135.
14. Hulland, J. (1999) Use of Partial Least Squares (PLS) in Strategic Management Research: A Review of Four Recent Studies. Strategic Management Journal, 20, 195-204.
15. Ibrahim, F., Münscher, J., Daseking, M., & Telle, N.-T. (2025). The technology acceptance model and adopter type analysis in the context of artificial intelligence. Frontiers in Artificial Intelligence, 7. https://doi.org/10.3389/frai.2024.1496518
16. Jaiswal, P. (2020). Integrating Educational Technologies to Augment Learners' Academic Achievements. International Journal of Emerging Technologies in Learning (iJET), 15(2), 145. https://doi.org/10.3991/ijet.v15i02.11809
17. Jutin, N. T., & Maat, S. M. B. (2024). The Effectiveness of Gamification in Teaching and Learning Mathematics: A Systematic Literature Review. International Journal of Academic Research in Progressive Education and Development, 13(1). https://doi.org/10.6007/ijarped/v13-i1/20703
18. Karnsomdee, P. (2025). E-Government Adoption in Thai Public Sector Organizations: Citizens' Perspective. Journal of Theoretical and Applied Electronic Commerce Research, 20(2), 103. https://doi.org/10.3390/jtaer20020103
19. Kešelj, A., Žubrinić, K., Miličević, M., & Kristić, M. (2025). Evaluation of Accessibility Parameters in Education Software That Supports Three-Dimensional Interactions. Applied Sciences, 15(10), 5258. https://doi.org/10.3390/app15105258
20. Kim, J. (2019). Multicollinearity and misleading statistical results. Korean Journal of Anesthesiology, 72(6), 558. https://doi.org/10.4097/kja.19087
21. Kim, Y. J., Chun, J. U., & Song, J. (2009). Investigating the role of attitude in technology acceptance from an attitude strength perspective. International Journal of Information Management, 29(1), 67. https://doi.org/10.1016/j.ijinfomgt.2008.01.011
22. Kline, R. B. (2012). Assumptions in structural equation modeling. Handbook of structural equation modeling, 111, 125.
23. Kontis, A.-P., & Ioannidis, S. (2025). Metaverse Tourism: An Overview of Early Adopters' Drivers and Anticipated Value for End-Users. Tourism and Hospitality, 6(2), 86. https://doi.org/10.3390/tourhosp6020086
24. Kowitlawakul, Y. (2025). The Technology Acceptance Model: Predicting Nurses'. https://journals.lww.com/cinjournal/abstract/2011/07000/the_technology_acceptance_model__predicting.7.aspx
25. Lantushenko, V., Lipton, A. F., & Erkis, T. (2018). Teaching basic spreadsheet skills with peer tutoring. Managerial Finance, 44(7), 885. https://doi.org/10.1108/mf-06-2017-0234
26. Le, M. T. H. (2021). Factors influence ease of use on Fintech adoption: Mediating by the role of attachment anxiety under Covid-19 pandemic. Ho Chi Minh City Open University Journal of Science-Economics and Business Administration, 11(2), 137. https://doi.org/10.46223/hcmcoujs.econ.en.11.2.1799.2021
27. Lin, T., Zhang, J., & Xiong, B. (2025). Effects of Technology Perceptions, Teacher Beliefs, and AI Literacy on AI Technology Adoption in Sustainable Mathematics Education. Sustainability, 17(8), 3698. https://doi.org/10.3390/su17083698
28. Mashabela, M. F., & Kekwaletswe, Professor. R. M. (2020). The Determinants for Accepting and Using e-Government Revenue Application (e-filing). International Journal of Innovative Science and Research Technology (IJISRT), 5(9), 476. https://doi.org/10.38124/ijisrt20sep298
29. Matsukawa, R., Okahara, A., Tokutome, M., Itonaga, J., Hara, A., Kisanuki, H., Sada, M., Okabe, K., Kawai, S., Matsuura, H., & Mukai, Y. (2023). Early Initiation of Sodium-Glucose Cotransporter 2

Inhibitor Leads to a Shorter Hospital Stay in Patients With Acute Decompensated Heart Failure. Circulation Reports, 5(5), 187. https://doi.org/10.1253/circrep.cr-22-0118

30. Murni, S. A., Bernard, M., Ruqoyyah, S., & Chotimah, S. (2020). PGSD student's mathematical creative thinking skills judging from creativity quotations by making vba-based teaching. Journal of Physics Conference Series, 1521(3), 32040. https://doi.org/10.1088/1742-6596/1521/3/032040
31. Neurath, R., & Stephens, L. J. (2006). The effect of using Microsoft Excel in a high school algebra class. International Journal of Mathematical Education in Science and Technology, 37(6), 721. https://doi.org/10.1080/00207390600989251
32. Palumian, Y., Jayanti, S., Indriyani, R., & Tarigan, Z. J. H. (2021). Technology acceptance model for online cinema ticketing among moviegoers in java island Indonesia: an empirical study on tix id application. IOP Conference Series Materials Science and Engineering, 1010(1), 12037. https://doi.org/10.1088/1757-899x/1010/1/012037
33. Prasetyo, Y. T., Roque, R. A. C., Chuenyindee, T., Young, M. N., Diaz, J. F. T., Persada, S. F., Miraja, B. A., & Redi, A. A. N. P. (2021). Determining Factors Affecting the Acceptance of Medical Education eLearning Platforms during the
34. Price, A., Perkins, K. K., Holmes, N. G., & Wieman, C. (2019). How and why do high school teachers use PhET interactive simulations? 2017 Physics Education Research Conference Proceedings. https://doi.org/10.1119/perc.2018.pr.price
35. Ramayah, T. J. F. H., Cheah, J., Chuah, F., Ting, H., & Memon, M. A. (2018). Partial least squares structural equation modeling (PLS-SEM) using smartPLS 3.0. An updated guide and practical guide to statistical analysis, 978-967.
36. Rodríguez-Calzada, L., Velasco, M. P., & Urquiza-Fuentes, J. (2024). The Educational Impact of a Comprehensive Serious Game within the University Setting: Improving Learning and Fostering Motivation. Heliyon, 10(16). https://doi.org/10.1016/j.heliyon.2024.e35608
37. Setälä, M., Heilala, V., Sikström, P., & Kärkkäinen, T. (2025). The Use of Generative Artificial Intelligence for Upper Secondary Mathematics Education Through the Lens of Technology Acceptance. Proceedings of the 37th ACM/SIGAPP Symposium on Applied Computing, 74. https://doi.org/10.1145/3672608.3707817
38. Sekaran, U. & Bougie, R. (2016) Research Methods for Business: A Skill-Building Approach. 7th Edition, Wiley & Sons, West Sussex.
39. Shahzad, M. F., Xu, S., Lim, W. M., Hasnain, M., & Nusrat, S. (2024). Cryptocurrency awareness, acceptance, and adoption: the role of trust as a cornerstone. Humanities and Social Sciences Communications, 11(1). https://doi.org/10.1057/s41599-023-02528-7
40. Shmueli, G., Sarstedt, M., Hair, J.F., Cheah, J.-H., Ting, H., Vaithilingam, S. and Ringle, C.M. (2019), "Predictive model assessment in PLS-SEM: guidelines for using PLSpredict", European Journal of Marketing, Vol. 53 No. 11, pp. 2322-2347.
41. Song, C., Helikar, R., Smith, W., & Helikar, T. (2023). Factors Influencing Instructors' Adoption and Continued Use of Computing Science Technologies: A Case Study in the Context of Cell Collective. CBE—Life Sciences Education, 22(3). https://doi.org/10.1187/cbe.22-11-0239
42. Tran, T. H. H., & Vu, T. D. (2025). Enhancing Renewable Energy Product Consumption of Young Customers Through Sustainable Development Goals Knowledge: An Application of the Theory of Planned Behavior. Sustainability, 17(9), 3784. https://doi.org/10.3390/su17093784
43. Trenerry, B., Chng, S., Wang, Y., Suhaila, Z. S., Lim, S. S., Lu, H., & Oh, P. H. (2021). Preparing Workplaces for Digital Transformation: An Integrative Review and Framework of Multi-Level Factors [Review of Preparing Workplaces for Digital Transformation: An Integrative Review and Framework of Multi-Level Factors]. Frontiers in Psychology, 12. Frontiers Media. https://doi.org/10.3389/fpsyg.2021.620766
44. Usman, B., Sentosa, I., & Nurrahmi, F. (2021). Structural equation modeling of internet of things (IoT) adoption for Indonesian Village-Owned Enterprises (BUMDes). INFORMASI, 51(1), 169. https://doi.org/10.21831/informasi.v51i1.40170
45. Venkatesh, V., & Bala, H. (2008). Technology Acceptance Model 3 and a Research Agenda on Interventions. Decision Sciences, 39(2), 273. https://doi.org/10.1111/j.1540-5915.2008.00192

46. Venkatesh, V., & Davis, F. D. (2000). A theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. Management Science, 46(2), 186–204. https://doi.org/10.1287/mnsc.46.2.186.11926
47. Vidmar, G. (2007). Statistically Sound Distribution Plots in Excel. https://www.researchgate.net/profile/Gaj_Vidmar/publication/228771343_Statistically_sound_distribution_plots_in_excel/links/00b495178e2ef896b4000000.pdf
48. Visconti, R. M. (2012). How to Prepare a Business Plan with Excel. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.2039748
49. Webb, G. (1987). Using Spreadsheet Software as an Aid in the Administration of Marks and Grades. PLET Programmed Learning & Educational Technology, 24(2), 151. https://doi.org/10.1080/0033039870240211
50. Wu, B., Chen, Y., & Naik, P. A. (2024). EXPRESS: How Own Delivery Services Influence Customer Behavior and Sales in Online Retail? Building Trust and Improving DeliveryQuality in Digital Economy. Journal of Marketing, 00222429241239892.
51. Zaineldeen, S., Li, H., Koffi, A. L., & Hassan, B. M. A. (2020). Technology Acceptance Model' Concepts, Contribution, Limitation, and Adoption in Education. Universal Journal of Educational Research, 8(11), 5061. https://doi.org/10.13189/ujer.2020.081106
52. Zhang, Z., Liu, M., & Yang, Q. (2021). Examining the External Antecedents of Innovative Work Behavior: The Role of Government Support for Talent Policy. International Journal of Environmental Research and Public Health, 18(3), 1213. https://doi.org/10.3390/ijerph18031213