 ISSN: 2473-4901
v8 n5807

Captive Audience: Mobile Learning Motivation Factors Mid-Pandemic

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Abstract

The study examines the motivating factors driving mobile information systems use (MISU) for mobile learning. The primary objectives include comparing attitudes of students and faculty towards the influence of perceived usefulness (PU), perceived playfulness (PP), and perceived enjoyment (PE) on MISU. Additionally, the influence of personal innovativeness (PI) on PU, PE, and PP is also assessed. The previous study examined these attitudes prior to the pandemic. This study focuses on the attitudes existing mid-pandemic, when new strategies toward m-learning were by necessity applied much more broadly than at any other time historically. The method used is a survey of quantitative constructs. Research contributions, limitations, and implications for future research are also discussed. Though student participants felt perceived usefulness led to mobile learning use mid-pandemic, faculty did not. Furthermore, neither group felt perceived usefulness yielded perceived usability.

Keywords: motivation, mobile learning, pandemic, m-learning, COVID-19

1. INTRODUCTION

Organizations of all types have benefited from the development and use of information systems ("Measuring Digital Development Facts and Figures 2021," 2021). With the explosion of mobile applications, also known as mobile information systems, new uses are emerging. One such application of mobile information systems is mobile learning, referred to as m-learning hereafter. M-learning has found its ways in the corporate world for employee training and development, and in higher education for teaching and student learning. However, m-learning has historically not seen the same extent of usage as distance learning and e-learning, often attributed to technological limitations.

Motivational factors, though, may also contribute to the slow adoption of m-learning. But quarantine on a global scale produced a new level of motivation. With schools no longer in person, participation in learning required online interaction. If the problems of m-learning usage are not well understood and addressed, then usage may possibly decrease and the opportunities inherent in m-learning may be missed. Extant literature includes numerous m-learning studies explicitly focused on student use and perceptions of m-learning. Faculty members, on the other hand, have not been the focus of

ISSN: 2473-4901
v8 n5807

many studies, despite the integral role that faculty motivation likely plays in the use of m-learning. In this study the attitudes of both faculty and student are examined mid-pandemic and compared to a previous study on attitudes pre-pandemic (Bhatnagar, 2019).

2. BACKGROUND

The pandemic shaped key trends on usage of the Internet. Though mobile broadband usage was originally expected to peak at 85 percent in 2020, instead now 95 percent has access to a mobile broadband network ("Measuring Digital Development Facts and Figures 2021," 2021). In spite of this coverage, blind spots persist in rural areas. In developing countries, the cost of connecting to mobile broadband remains high, which restricts access.

M-learning mainly involves the use of mobile devices and wireless technologies (Pereira & Rodrigues, 2013) for training, learning, and teaching purposes (Sarrab, Elgamel, & Aldabbas, 2012) and this is the definition that was used in the context of this research study. This relationship in shown in Figure 1. Eteokleous and Ktoridou (2009) referred to m-learning as a successor of e-learning. They defined e-learning as learning that takes place with the use of digital electronic tools and media.

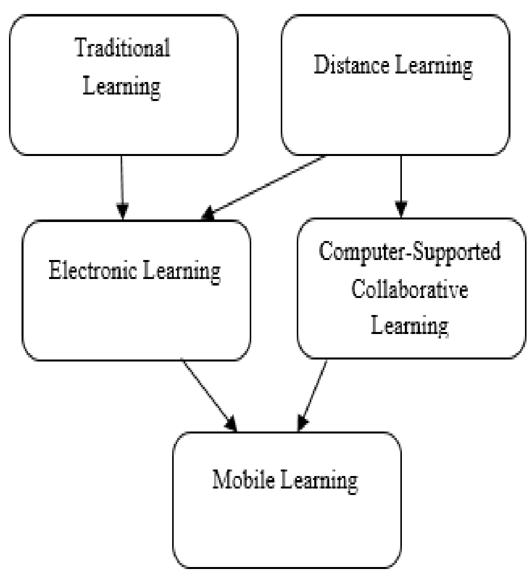

Figure 1: Illustration of the evolution of learning models (Pereira & Rodrigues, 2013)

E-learning moved from being part of the informal education system to mainstream in learning delivery ("78 Essential LMS and eLearning Software Statistics: 2022 Data Analysis & Market Share," 2022). Widespread acceptance of online learning is expected to continue post-pandemic. Cloud-based Learning Management System (LMS) have enabled the rapid adoption of the technology. The millennial population in the workforce is also a driver in the increased use of m-learning tools.

Some studies have started tracking the pandemic impact on m-learning. In the study of m-learning for medical education, the importance of connecting stakeholders (both students and faculty) and using meaningful interaction with the m-learning was exposed (Kalantrion et al., 2022). A study of online learning students in Macao suggests that learning motivation, even in the case of forced adoption of online, is key to success (Zhang, Lam, & Su, 2021). A study of m-learning in the less developed country of Libya points out the importance of good Internet connectivity to acceptance even during the forced adoption caused by the pandemic (Maatuk, Elberkawi, Aljawarneh, Rashaideh, & Alharbi, 2022).

Though the steps for making radical changes in organizations have been previously studied (Cameron & Green, 2019), most organizations did not have the option of controlled change during pandemic. The typical mitigating actions that would have cushioned the migration to m-learning such as leading communications, satisfying needs for emotional security, etc. (Weiss & Li, 2020) were abbreviated at best. Furthermore, the assault of change was felt not just on learning, but in all aspects of existence.

Various theories have been used to explore attitudes and experiences related to m-learning. The Technology Acceptance Model (TAM) is frequently used in industry and in university settings (Buabeng-Andoh, 2021). The m-learning paradigm has even inspired Mobile Technology Acceptance Model (MTAM) which adds personal innovativeness and usefulness as constructs driving adoption (Yuan, Tan, Ooi, & Lim, 2021). In a study focused on pedagogy and motivation, a combination of Bloom's taxonomy and Malone and Lepper's taxonomy was used as the study framework (Troussas, Krouska, & Sgouropoulou, 2022).

Similar to Bhatnagar (2019), perceived usefulness and perceived playfulness has been

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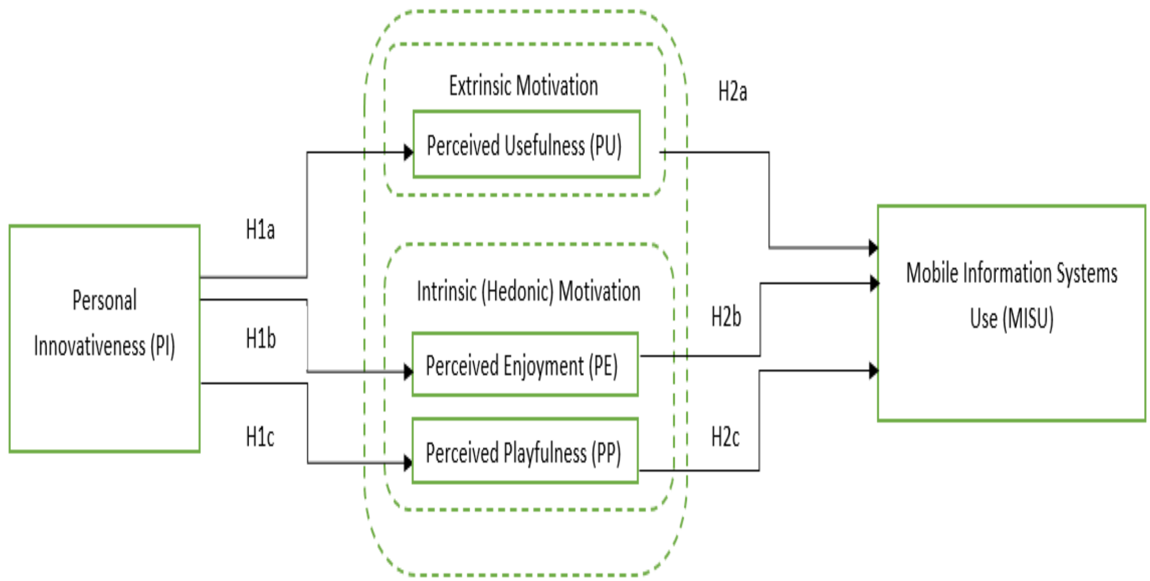

Figure 2: Proposed Theoretical Model adopted from Hwang (2014)

used to explore student acceptance and rejection of the mobile learning apps (Al-Bashayreh, Almajali, Altamimi, Masa'deh, & Al-Okaily, 2022). This study was created very early in the pandemic. It was noted in future directions in Almajali et al. (2022) that though pre-pandemic conditions validated the relationships between playfulness and intent to use, the pandemic created an atypical situation where acceptance may have been forced on students.

3. THEORY

As seen in Al-Bashayreh, Almajali, Altamimi, Masa'deh, & Al-Okaily (2022) the influence of both intrinsic and extrinsic motivation factors on mobile information systems use (MISU) was tested. Intrinsic motivation factors assessed included perceived enjoyment (PE) and perceived playfulness (PP). One extrinsic motivator factor was assessed, perceived usefulness (PU). Additionally, the influence of personal innovativeness (PI) on PU, PE, and PP was also assessed.

The central research question that emerged from the current state of m-learning research was how to determine effective use of mobile devices in the context of mobile information system applications such as m-learning. Exploring how to integrate m-learning effectively (Crow, Santos, LeBaron, McFadden, & Osborne, 2010; Lam, Yau, & Cheung, 2010) is an important issue that lacks understanding (Eteokleous & Ktoridou, 2009) and is a major barrier for its use. It is not enough to look only at how mobile devices can be integrated.

For this study, these specific research questions were examined.

RQ1: What are the motivating factors driving m-learning use?

RQ2: How is m-learning being used for teaching, learning, and training?

The hypotheses seen in Figure 3 were tested using the theoretical model (Figure 2) to answer both research questions via the survey instrument. PI will positively and significantly influence PU, PE, and PP (H1a, H1b, H1c) and PU, PE, and PP will positively and significantly influence MISU (H2a, H2b, and H2c).

4. METHODOLOGY AND PROCEDURE

Institutional Review Board approval was received at the primary investigator's institution prior to commencing the study. An online survey was created using Qualtrics and analyzed using Structural Equation Modeling. The questions replicated those used in a study of pre-pandemic attitudes towards mobile learning (Bhatnagar, 2019). The survey also contained questions to

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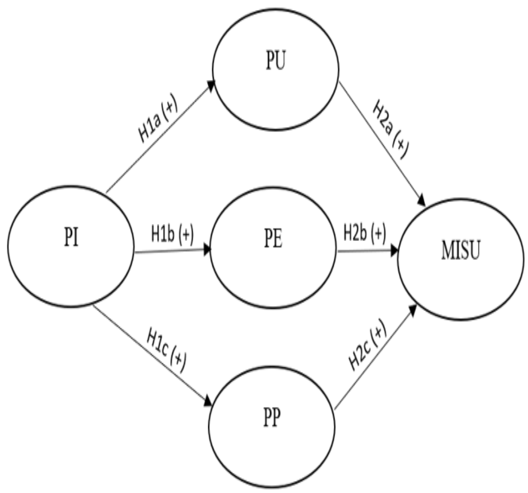

Figure 3: Conceptual Map of the Research Model

help understand how m-learning is being used for teaching and learning. For details, please see Appendix A (Faculty Survey Instrument) and Appendix B (Student Survey Instrument).
Participants were contacted via email and requested to participate in the study. Whereas the previous study focused only on faculty teaching in the disciplines of computer science, information systems, and business at 60 institutions of higher education (both public and private) who are members of the Association of American Universities (AAU) in the United States, this study was expanded to also include students. Faculty and students at a regional campus of an R1 university in western Pennsylvania along with international students at a European university took the survey. This provides a sample set with wider cultural representation.

The initial email was sent to a total of 959 undergraduate students, 16 graduate students and 186 faculty. A reminder email was sent after one week to 979 undergraduate students and 187 faculty. Additional students had been added to the shared email list in the time since the initial email, so more students were contacted in the reminder. The response rates for both faculty and students were significantly at 9% and 4% respectively.

The data was first cleaned by removing blank records, and incomplete responses. The data was then coded. Microsoft Excel, SPSS and SmartPLS were used for the data analysis.

In addition to the questions of the original survey (Bhatnagar, 2019), a measurement of usability was also taken using the System Usability Scale (SUS) metric. The importance of usability due to the pandemic forced adoption (Uthman & Ahmed, 2022) seemed to be a critical factor. Though previous studies of the effect of Computer Anxiety (CA) had not shown a direct relationship between CA and the intention to use (Ball & Levy, 2008), studies during the pandemic have shown otherwise (Alsubaie, Alzarah, & Alhemly, 2022). The amount of change induces technostress which means more attention needs to be paid to the student and faculty experience.

The reliability and validity of SUS has been documented by 20 years of SUS Scores (Sauro, 2011). Reliability refers to the consistent response to the items. SUS detects differences in smaller sample sizes (as few as two users) and generates reliable results. Validity refers to whether an instrument measures the target, which for SUS is perceived usability. SUS has been shown to effectively distinguish between unusable and usable systems and correlates highly with other questionnaire-based measurements of usability. These characteristics combine to make SUS an improvement to commercial alternatives and home-grown questionnaires (Sauro, 2011). The SUS provides a comprehensive measure in addition to the dimensionality measures of the original instrument.

The discussion of key results is divided into two sections. The first section provides a comparison of the results between the pre-pandemic and mid-pandemic findings. The second section looks at the student data results.

5. COMPARISON PRE/MID PANDEMIC RESULTS FOR FACULTY

SPSS was used to perform pre-analysis data screening. Outliers, or extreme cases, in the data were evaluated for all datasets using both the univariate and multivariate techniques. Since the data was coded on a 7-point Likert scale a visual inspection of the data showed no univariate outliers. With 24 items, the degrees of freedom is 24 and the critical value for chi-square at $p<.001$ equals 51.179. For the current study, the analysis called for the elimination of one case, but it was not removed. In the pre-pandemic study six cases had to be removed since the Mahalanobis distance was greater than 51.179.

Structural model analysis was done in two parts. The measurement model focuses on internal

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consistency reliability, convergent validity, and discriminant validity. The structural model is assessed by evaluating collinearity, the significance of path coefficients, the level of R^2 values, the f^2 effect size, the predictive relevance (Q^2), and the q^2 effect size (Hair Jr, Hult, Ringle, & Sarstedt, 2013). For details, please see Appendix E (Pre-Pandemic Faculty Data Analysis) and Appendix F (Mid-Pandemic Faculty Data Analysis).

Measurement Model

Internal consistency reliability is measured by evaluating composite reliability and Cronbach's alpha. Composite reliability ranges between zero and one. The higher the number, the higher the composite reliability. Cronbach's alpha greater than 0.8 are good. The model showed strong internal consistency reliability for both the pre-pandemic and mid-pandemic studies.

The two most common measures of construct validity are convergent and discriminant validity. Any reflective indicator whose outer loading is below 0.4 should be removed. However, indicators with outer loadings between 0.4 and 0.7 should be further analyzed by looking at the impact on composite reliability and average variance extracted (AVE) before any elimination takes place (Hair Jr et al., 2013).

In the pre-pandemic study, MISU7 had an outer loading of -0.358, in this study it is 0.044. Since it is below 0.4, it should be removed. PP1 and PP2 have outer loadings between 0.4-0.7, 0.681 and 0.697 respectively (in the previous study with 0.641 and 0.495 respectively). These were further examined by looking at the impact on composite reliability and average variance extracted (AVE) before their elimination. As was the case in the previous study, composite reliability, Cronbach's alpha, and AVE are greatly improved by removing MISU7, PP1, and PP2. These three indicators were removed prior to completing the remainder of the analysis. The indicator reliability is the squared value of an indicator's outer loading.

Discriminant validity is assessed by examining the indicator cross loadings and the Fornell-Larcker criterion. In both studies these were met without any issues.

Structural Model

The structural model is assessed by evaluating collinearity, the significance of path coefficients, the level of R^2 values, the f^2 effect size, the predictive relevance (Q^2), and the q^2 effect size (Hair et al., 2013). These are discussed next.

SPSS was used to assess collinearity. Collinearity involves examining tolerance levels and the variance inflation factor (VIF). Tolerance levels below 0.2 and VIF above 5.0 are indicators of collinearity. In both studies the results indicate no collinearity issues.

Structural model path coefficients should be between -1 and +1. Coefficients that are close to +1 represent a strong positive relationship, -1 a

Model	Pre-Pandemic	Mid-Pandemic
Measurement	Strong internal consistency reliability	Strong internal consistency reliability
	Convergent validity achieved after removing MISU7, PP1, and PP2	Convergent validity achieved after removing MISU7, PP1, and PP2
	Discriminant validity was achieved	Discriminant validity was achieved
Structural	No collinearity issues were found	No collinearity issues were found
	All paths except H2c were positive	All paths except H2c were positive
	H2b and H2c were rejected as they were not significant	H2a, H2b, and H2c were rejected as they were not significant
	R^2 values showed weak predictive accuracy	PI did not appear in the results, R^2 values for remaining constructs show moderate predictive accuracy
	Effect size (f^2) was small for H1a and H2a, medium for H1c, and large for H1b	Effect size (f^2) was small for H2c, medium for H2a and H2b, and large for H1a, H1b, and H1c
	Q^2 values indicated model has minimal predictive relevance	Q^2 values indicated model has a strong predictive relevance
	q^2 effect size very small for PE, PU, and PP.	q^2 effect size medium for PE and PU and small for PP

Table 1: Comparative Analysis of Results for Faculty

 ISSN: 2473-4901
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strong negative relationship, and close to zero a weak or nonsignificant relationship (Hair et al., 2013). Since the hypotheses for the study are unidirectional, this implies a one-tailed test. In the pre-pandemic study, two of the paths were not significant, from PE to MISU (rejecting H2b) and from PP to MISU (rejecting H2c). In this study besides these two, the path from PP to MISU is also not significant (rejecting H2a).

The coefficient of determination, R^2, value ranges from 0 to 1 and there is no agreed upon value for an acceptable R^2 value (Hair et al., 2013). However, Hair et al. stated that values of 0.75 (substantial), 0.50 (moderate), and 0.25 (weak) can be used as a rule of thumb. Based on the results, MISU, PE, PI, and PP had weak predictive accuracy in the pre-pandemic study. In this study, PI did not appear in the results and the remaining constructs have a moderate predictive accuracy.

According to Hair et al. (2013), effect size (f^2) values of 0.02 (small), 0.15 (medium), and 0.35 (large) are the effect sizes that should be used to evaluate the structural model. In the previous study, PI had a large effect on PE, a medium effect on PP. and a small effect on PU and PU had a small effect on MISU. In this study, PI has a large effect on PU, PE, and PP whereas PU and PE have medium effects on MISU and PP has a small effect on MISU.

Blindfolding is a method used to calculate predictive relevance (Q^2). Q^2 indicates the model's predictive relevance (Hair Jr et al., 2013). Assessment of Q^2 uses the same values for small, medium, and large as f^2. While the pre-pandemic study showed the model to have some predictive relevance, even if minimal, in the current study the model has a stronger predictive relevance.

Just as f^2 effect size is used to assess R^2 values, relative impact of predictive relevance can be compared by means of the measure to the q^2 effect size (Hair Jr et al., 2013). The equation to calculate the q^2 effect is seen below.

(Q^2 included – Q^2 excluded) / (1-Q^2 included)

The values of 0.02, 0.15, and 0.35 show small, medium, or large predictive relevance. MISU is
The values of 0.02, 0.15, and 0.35 show small, medium, or large predictive relevance. MISU is the endogenous variable. By removing each of the latent variables (PE, PU, and PI) one at a time, and calculating the predictive relevance, determines the effect size of each latent variable on the endogenous variable. In the previous study it was determined that all predictor variables had a very small effect size. In this study, PE and PU have a medium effect size while PP has a small effect size. Table 1 summarizes the findings of the mid- and pre-pandemic data results for faculty.

Faculty Demographics
In the current study, analysis of the faculty demographics showed that the survey was completed primarily by females (56%) in the age ranges shown in Figure 4. Overwhelmingly 81% have earned doctorate degrees and teach in disciplines other than Information Systems, Business, and Computer Science. The disciplines in which participants obtained their higher degree was wide ranging. All participants (100%) teach at the undergraduate level. It was interesting to find that 31% of them teach on-campus (i.e. in-person, face-to-face) and hybrid in spite of the pandemic.

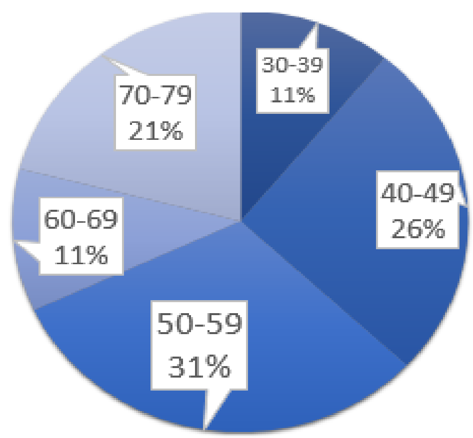

Figure 4: Faculty age range

The average number of years of teaching experience is 22 years and the average number of years in higher education is 20 years. A majority are employed full-time (75%) and teach at a public university (94%). The average years of teaching on-campus are 19, online 5, and hybrid 3. Most are not on tenure track (62%). For details, please see Appendix D (Faculty Demographics Analysis.

Pre-Pandemic M-Learning Uses
The uses of m-learning (which address RQ2) showed that 18% of the participants using m-learning (n=87) used four of the five options provided: in-class and out-of-class activities,

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online and hybrid course. Around 8% used one or more combinations of the options provided. The types of activities being used for m-learning in teaching were wide ranging (see Appendix H for the types of activities).

Of the 87 participants who identified themselves as users of m-learning, three (3%) stated that they had been using m-learning for less than one year, 55 (63%) started using m-learning between 1 to 6 years ago, seven (8%) between 7 to 10 years, and 22 (25%) had started using it over ten years ago. Seventy-six (87%) use it anywhere from several times a day to 3-5 days a week. The remaining 11 participants (or 12%) use it less frequently. Sixty-three (72%) of the 87 participants stated that they felt moderately or very comfortable using m-learning.

Teaching resources provided on a mobile device resulted in 61 combinations of choices. The top three choices accounted for 17% of the resources used. These include using a combination of lecture PPT slides, audio, and video recordings, print content, eBooks, hyperlinks to course-related reference material, and Blackboard. Some participants also provided information on other resources provided to students on a mobile device. The most commonly listed system was Canvas.

In general, most participants (86%) expressed a level of satisfaction in using m-learning that ranged between somewhat to mostly satisfied. Hardware used for m-learning primarily includes generic laptops, phones, video cameras, computers, and e-readers. Next would be all the Apple products (iPhone, iPad, mac, MacBook). The predominant software used is Canvas. Others used are wide-ranging (Bhatnagar, 2019).

Mid-Pandemic M-Learning Uses

Faculty are currently using m-learning for all of the following options (in various types of combinations): in-class and out-of-class activities, online course, hybrid course, as well as for professional development/training. All 16 participants started using m-learning over a year ago, eleven (70%) have been using it between 1 to 6 years, two (12%) have been using it between 7 to 10 years, and the remaining three (18%) have been using it over 10 years. Sixty-two percent use it anywhere from several times a day to about once a day. Twenty-five percent use it 3-5 days a week, twelve percent use it 1-2 days a week, twelve percent use it every few weeks or less often, and only six percent has never used it. Two new questions were added to the survey. The first asked if participants were given a choice other than mobile learning during the pandemic. Thirty-seven percent said yes, and sixty-three percent said no.

Of those that stated they were not given a choice, all participants stated that they did not choose to not teach to avoid mandatory mobile learning. Almost seventy percent stated they are moderately or very comfortable in using m-learning. Teaching resources provided on a mobile device resulted in 14 combinations from the choices that were provided. Some of these choices included lecture PPT slides, audio, and video recordings, among others. A majority (87.5%) expressed a level of satisfaction ranging from neither satisfied nor dissatisfied to somewhat satisfied. Participants were asked to identify how frequently they engaged in various types of activities using their mobile devices to support teaching (see Appendix H for a breakdown of the responses). In a follow-up question most participants (68%) said they did not engage in any other activities using mobile devices to support teaching.

Hardware used for m-learning primarily includes phones and laptops. Canvas is the learning management system used at the regional campus where the survey was administered and chosen by majority of the participants. There were a myriad of other software programs identified, some discipline specific.

6. MID-PANDEMIC STUDENT RESULTS

As discussed earlier, students were added to the study for the mid-pandemic study. In the conditions of the mid-pandemic, it was felt student results, though not part of the previous study, were also relevant. This section analyzes the student data.

Measurement Model

There were no outlier cases with a value greater than 51.179 that had to be eliminated. The model showed strong internal consistency reliability for all constructs except PP. Convergent validity analysis showed the outer loadings for PP1 between 0.4 and 0.7 and below 0.4 for MISU7 and PP2. As such composite reliability, Cronbach's alpha, and AVE greatly improve by removing MISU7, PP1, and PP2. These indicators were removed before proceeding the remainder of the analysis. Indicator cross loadings and the Fornell-Larcker criterion were met without any issues indicating no issues with discriminant validity.

Structural Model

Analysis of the constructs showed collinearity issues with PP in terms of tolerance and VIF. Based on the structural model and path coefficients, two of the paths were not significant, from PI to PE (rejecting H1b) and from PP to MISU (rejecting H2c). The coefficient of determination (R^2) values for PE, PI, and PP indicate weak predictive accuracy. In terms of effect size (f^2), PU and PE have a large effect on MISU, PI has a medium effect on PE, PU, and PP, and PP has a small effect on MISU. Blindfolding and predictive relevance (Q^2) showed that the model does have predictive relevance. Effect size (q^2) indicates that all predictor variables have a medium to large effect size. For details, please see Appendix G (Mid-Pandemic Student Data Analysis).

Student Demographics
Analysis of the student demographics questions shows that the average age of the participants is 20 years old. The survey was completed by more females (48%) than males (46%). A majority of the students were undergraduates (78%) and 19% were graduate students. The graduate students were primarily pursuing business degrees while the undergraduate students represented a variety of disciplines such as business, management, biological sciences, information technology/cybersecurity, nursing, psychology, among others. Some of the disciplines were listed as double majors. For details, please see Appendix C (Student Demographics Analysis).

7. DISCUSSION

Several important conclusions emerge from the analysis. The results of the study related to the hypotheses are shown in Table 2.

Hypotheses	Construct	Pre	Mid
H1a	PI → PU	Accept	Accept
H1b	PI → PE	Accept	Accept
H1c	PI → PP	Accept	Accept
H2a	PU → MISU	Accept	***Reject***
H2b	PE → MISU	Reject	Reject
H2c	PP → MISU	Reject	Reject

Table 2: Summary of Hypotheses

Pre/Mid Pandemic (Faculty)
In both the pre-pandemic and the current study, PI did positively and significantly influence PU, PE, and PP. This led to accepting H1a, H1b, and H1c. Hwang's (2014) research had explored testing the impact of personal innovativeness of IT (PIIT) on the intrinsic motivation factors perceived enjoyment (PE) and perceived ease of use (PEOU) and the extrinsic motivation factor of perceived usefulness (PU) as it related to the use of ERP systems. Hwang arrived at similar conclusions with PIIT influencing PE, PEOU, and PU. In the context of both studies, the fact that PI positively and significantly influences PE, PU, and PP implies that the participants are willing to try using new technologies, such as mobile information systems, because they find these systems to be useful, enjoyable, and like interacting with these.

Also in the pre-pandemic study, PU was found to positively influence MISU, but this is not the case for the mid-pandemic study. Prior to the pandemic, this implied that participants are using mobile information systems (m-learning) because they find m-learning to be useful for teaching and student learning. Even earlier studies of the impact of PU on IS continuance intention using Blackberry hardware showed PU positively impacted IS use (Chen, Meservy, & Gillenson, 2012).

For the mid-pandemic, in spite of perceived usefulness, the participants did not find that a motivator for MISU.

Third, in the previous study, PE and PP did not influence MISU which meant that using mobile information systems for m-learning was not perceived to be enjoyable or interesting to use or that enjoyment and playfulness were not the reasons that would influence using mobile information systems, such as m-learning. This is also true for the current study.

Fourth, based on R^2 and Q^2 values, the model has a weak predictive accuracy and minimal predictive relevance, whereas in the current study, the model shows moderate predictive accuracy and a strong predictive relevance.

Fifth, in the pre-pandemic study, the f^2 of PE and PP has no effect on MISU, which also confirmed the rejection of H2b and H2c while the other effect sizes confirm accepting H1a, H1b, H1c, and H2a. In the current study, there were no f^2 values which had no effect on MISU even though the structural paths indicate that H2a, H2b and H2c should be rejected.

Lastly, in the previous study the q^2 effect size showed little to no significance for PE, PU, and PP while in the current study the significance is small for PP and medium for PE and PU.

Mid-Pandemic (Student)

As seen in Table 3, the student results matched the faculty response for H1a, H1c and H2c. The effect of PI on PE was rejected by the students (H1b). Unlike the faculty in the mid-pandemic result, the effect of PU and PE on MISU were accepted.

Hypotheses	Construct	Result
H1a	PI → PU	Accept
H1b	PI → PE	Reject
H1c	PI → PP	Accept
H2a	PU → MISU	Accept
H2b	PE → MISU	Accept
H2c	PP → MISU	Reject

Table 3: Summary of Hypotheses (Student)

The students do feel enjoyment will encourage MISU. But they do not feel that playfulness will encourage MISU. Considering that these results were obtained in a time period where adoption of MISU was mandatory due to the pandemic, students may be expressing a frustration with the lack of options.

SUS

Examining the SUS data from both the faculty and student revealed the perception of a lack of usability in the m-learning applications. Analysis of the SUS data typically yields a letter grade of A-F. The participants rated the usability of m-learning at a solid D, or barely acceptable.

This finding is interesting, in light of the contrast between student and faculty results for perceived enjoyment. Student results did support that PE positively influenced MISU. Faculty results did not. But neither rated the usability of m-learning favorably. Once again, this points to the technostress induced by the intense and rapid implementation due to COVID-19 (Uthman & Ahmed, 2022). The stress on both faculty and students did not make them feel m-learning systems were usable.

In addition, the 81% of the faculty participants were not teaching the more technological subjects of Information Systems, Computer Science, or Business. The low usability score may also be affected by lesser expertise in technology.

8. CONTRIBUTIONS, LIMITATIONS, AND FUTURE RESEARCH

Contributions

The results achieved from the study are valuable and provide significant contributions to the body of knowledge. The research helped 1) identity motivation factors driving the use of mobile information systems for m-learning, 2) understand how m-learning is being used for teaching, learning, and training, 3) identify factors impeding m-learning use. The research extends prior research on m-learning which has been deficient in understanding faculty use of m-learning.

No prior research studies were found that looked at motivation factors for the use of m-learning and were limited on understanding faculty use with most research focused on student use. Research on information systems use is ample but research focusing on mobile information systems use is limited or nonexistent. This is the unique contribution of this research to the fields of HCI/UX, Information Systems, and M-learning.

Limitations

Limitations of both the pre-pandemic and mid-pandemic studies include the limited participants who were contacted to participate in the study, affecting the generalizability of the studies. The mid-pandemic study had a specific window of time to gather results before conditions shifted again. Additionally, the low response rate and self-reporting by participants completing an online survey may have introduced bias in the responses received.

Future Research

Given the limited scope of the study, it is evident that more research is needed. It should also be expanded to include more institutions of higher education and additional disciplines. Non-response rate and the generalizability of the study must also be accounted for. Grounding the study in other information systems theories that may better explain use or non-use is also suggested. This would allow investigating other factors beyond PI, PU, PE, and PP, such as resistance to use. Finally, as suggested by Ball and Levy (2008), research on methods to encourage instructors in the use of emerging technology would benefit both the researchers and practitioners. Such research could address the technostress (Uthman & Ahmed, 2022) experienced by both students and instructors.

It is hoped the results of this study may be compared to future research that repeats these questions in a post-pandemic world. In the future study the constructs PP1, PP2, and MISU7 (as seen in Figure 1) should not be included because composite reliability, Cronbach's alpha, and AVE are improved when they are removed.

9. CONCLUSION

The data for motivating factors shows some differences between faculty and student attitudes towards m-learning. Some shift in perception is also shown based on pre-pandemic to mid-pandemic. As the situations surrounding the implementation of m-learning continue to shift, it will be of interest to see how this influences the attitudes of faculty and student. Information System (IS) educators should be aware of the negative attitudes towards perceived usefulness and perceived usability of m-learning systems.

10. ACKNOWLEDGEMENTS

The portion of this research that took place at a European university was supported by the U.S scholar program through the Fulbright commission. The authors would also like to thank the participants for providing data in a timely manner to allow analysis at this unique point in m-learning usage.

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APPENDIX A
Faculty Survey Instrument

1 Which of the following best describes YOUR use of m-learning at your current institution? Please check all that apply.
For in-class activities
For out-of-class activities
For an online course
For a hybrid course (combination of in-class and online)
For professional development/training

Scale for items 2 through 6:

[1] strongly disagree, [2] disagree, [3] strongly disagree, [4] neither agree or disagree, [5] slightly agree, [6] agree, [7] strongly agree

2 Personal Innovativeness (PI) - "willingness of an individual to try out any new information technology." (Agarwal & Prasad, 1998, p. 260)
PI1. If I hear about new information technology, I will look for ways to experiment with it.
PI2. Among my faculty peers, I am usually the first to try out new information technologies.
PI3. In general, I am not hesitant to try out new information technologies.
PI4. I like to experiment with new information technologies.

3 Perceived Usefulness (PU) - "degree to which a person believes that using a particular system would enhance his or her job performance." (Davis, 1989, p. 320)
PU1. Using m-learning makes it easier to teach.
PU2. Using m-learning enhances my teaching effectiveness.
PU3. Using m-learning gives me greater control over teaching.
PU4. I find m-learning to be useful in my teaching.

4 Perceived Enjoyment (PE) - "extent to which the activity of using the computer is perceived to be enjoyable in it's own right, apart from any performance consequences, that may be anticipated." (Davis et al., 1992, p. 1113)
PE1. Using m-learning is fun.
PE2. Using m-learning is enjoyable.
PE3. Using m-learning is very entertaining (pleasant).
PE4. Using m-learning is interesting.

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5 Perceived Playfulness (PP) - "the extent to which the individual finds the interaction intrinsically enjoyable or interesting." (Moon & Kim, 2001, p. 219)
PP1. When using m-learning, I will not realize the time elapsed.
PP2. When using m-learning, I will forget the work I must do.
PP3. Using m-learning will give enjoyment to me for my teaching.
PP4. Using m-learning will stimulate my curiosity.
PP5. Using m-learning will lead to my exploration.

6 Mobile Information System Use (MUSE) - involves the use of mobile devices to use an information system to "...carry out tasks and activities on the job for which the information system is designed to support" (Sun & Teng, 2012). Examples would include using learning management systems such as Blackboard and Banner.
MISU1. I use mobile information systems on a regular basis.
MISU2. I will continue to use mobile information system in the future.
MISU3. I intend to continue using mobile information systems.
MISU4. I want to continue using mobile information systems rather than discontinue.
MISU5. I predict I will continue using mobile information systems.
MISU6. I plan to continue using mobile information systems.
MISU7. I will stop using mobile information systems in the future.

7 Rate each of the following statements:

[1] strongly disagree, [2] disagree, [3] neither agree or disagree, [4] agree, [5] strongly agree

I think that I would like to use mobile learning frequently.
I found mobile learning to be simple.
I thought mobile learning was easy to use.
I think that I could use mobile learning without the support of a technical person.

I found the various functions in mobile learning were well integrated.
I thought there was a lot of consistency in mobile learning.

I would image that most people would learn to use mobile learning very quickly.
I found mobile learning very intuitive.
I felt very confident using mobile learning.
I could use mobile learning without having to learn anything new.

8 How long ago did YOU start using m-learning?
Less than 1 year)
1-2 years
3-4 years
5-6 years
7-8 years
9-10 years

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More than 10 years

9 How often do YOU use m-learning? Please check all that apply.
Several times a day
About once a day)
3-5 days a week
1-2 days a week
Every few weeks
Less often
Never

10 Were you given a choice other than mobile learning during the pandemic?
Yes
No

If Were you given a choice other than mobile learning during the pandemic? = No

11 Did you choose to not teach to avoid mandatory mobile learning?
Yes
No

12 What is your level of comfort in using m-learning?
Very uncomfortable
Moderately uncomfortable
Slightly uncomfortable
Neutral
Slightly comfortable
Moderately comfortable
Very comfortable

13 Which of the following teaching resources do YOU provide on a mobile device? Select all that apply.
Lecture PPT slides
Audio recordings (e.g. recordings of lectures, school information)
Videos (e.g. course-related, recordings of lectures, school information)
Print content
Ebooks
Flashcards and other interactive educational games
Hyperlinks to course-related reference material
Blackboard
Other: please specify ____

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14 Rate your level of satisfaction with the use of m-learning.
Completely dissatisfied
Mostly dissatisfied
Somewhat dissatisfied
Neither satisfied or dissatisfied
Somewhat satisfied
Mostly satisfied
Completely satisfied

15 How frequently do you engage in the following activities using your mobile device(s) to support teaching?
[1] Never, [2] Rarely, [3] Occasionally, [4] Sometimes, [5] Frequently, [6] Usually, [7] Always

Emailing students
Emailing colleagues
Texting students
Texting colleagues
Posting grades
Posting to discussion boards
Accessing course site
Accessing library resources
Accessing social networking
Ordering textbooks
Searching the internet
Providing tutoring services
Preparing lessons
Conducting seminars
Collecting content for coursework
Reading ebooks
Taking pictures or making videos to include in your courses

As a follow-up to the previous question, do you engage in any other activities using your mobile device(s) to support teaching?

Yes, please specify: _______________
No

16 What technologies do you use for m-learning (hardware, software)?
____

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17 To which gender identify do you most identify?
Male
Female
Transgender female
Transgender male
Gender variant/non-conforming
Not listed
Prefer not to answer

18 Please indicate your age group
20-29
30-39
40-49
50-59
60-69
70-79
80 and over

19 Your number of years of teaching experience:
____

20 Your number of years in higher education:
____

21 Your academic rank
Lecturer
Instructor
Assistant Professor
Associate Professor
Professor
Emeritus
Other: please specify ___________________________________

22 Please indicate highest education level achieved.
Master's
Doctorate
Professional degree: please specify
____
Other: please specify ___________________________________

23 Please indicate the discipline in which you obtained your highest degree:
____

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24 Please indicate your program area/discipline in which you are currently teaching:
Information Systems
Business: please specify ____
Computer Science
Other: ____

25 What college level are you teaching?
Undergraduate
Graduate
Both undergraduate and graduate

26 Do you teach courses for students? Select all that apply.
on-campus (in-person, face-to-face)
off-campus (purely online)
hybrid (on-campus and online)

27 How long have you been teaching on campus? (i.e. in-person, face-to-face) courses?
____

28 How long have you been teaching online courses?
____

29 How long have you been teaching hybrid courses?
____

30 Do you teach full-time or part-time?
full-time
part-time

31 Please indicate the type of university you are currently affiliated with.
Public
Private

32 What is your tenure status?
Currently hold tenure at this institution
Currently on tenure-track at this institution
Not on tenure-track at this institution
Tenure is not available at this institution

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APPENDIX B
Student Survey Instrument

Scale for items 1 through 5:

[1] strongly disagree, [2] disagree, [3] strongly disagree, [4] neither agree or disagree, [5] slightly agree, [6] agree, [7] strongly agree

1 Personal Innovativeness (PI) - "willingness of an individual to try out any new information technology." (Agarwal & Prasad, 1998, p. 260)

PI1. If I hear about new information technology, I will look for ways to experiment with it.

PI2. Among my student peers, I am usually the first to try out new information technologies.
PI3. In general, I am not hesitant to try out new information technologies.
PI4. I like to experiment with new information technologies.

2 Perceived Usefulness (PU) - "degree to which a person believes that using a particular system would enhance his or her job performance." (Davis, 1989, p. 320)

PU1. Using m-learning makes it easier to learn.
PU2. Using m-learning enhances my learning effectiveness.
PU3. Using m-learning gives me greater control over learning.
PU4. I find m-learning to be useful in my learning.

3 Perceived Enjoyment (PE) - "extent to which the activity of using the computer is perceived to be enjoyable in it's own right, apart from any performance consequences, that may be anticipated." (Davis et al., 1992, p. 1113)
PE1. Using m-learning is fun.
PE2. Using m-learning is enjoyable.
PE3. Using m-learning is very entertaining (pleasant).
PE4. Using m-learning is interesting.

4 Perceived Playfulness (PP) - "the extent to which the individual finds the interaction intrinsically enjoyable or interesting." (Moon & Kim, 2001, p. 219)
PP1. When using m-learning, I will not realize the time elapsed.
PP2. When using m-learning, I will forget the work I must do.
PP3. Using m-learning will give enjoyment to me for my learning.
PP4. Using m-learning will stimulate my curiosity.
PP5. Using m-learning will lead to my exploration.

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5 Mobile Information System Use (MUSE) - involves the use of mobile devices to use an information system to "...carry out tasks and activities on the job for which the information system is designed to support" (Sun & Teng, 2012). Examples would include using learning management systems such as Blackboard and Banner.

MISU1. I use mobile information systems on a regular basis.
MISU2. I will continue to use mobile information system in the future.
MISU3. I intend to continue using mobile information systems.
MISU4. I want to continue using mobile information systems rather than discontinue.
MISU5. I predict I will continue using mobile information systems.
MISU6. I plan to continue using mobile information systems.
MISU7. I will stop using mobile information systems in the future.

Scale for question 6:

[1] strongly disagree, [2] disagree, [3] neither agree or disagree, [4] agree, [5] strongly agree

6 Rate each of the following statements:

I think that I would like to use mobile learning frequently.
I found mobile learning to be simple.
I thought mobile learning was easy to use.
I think that I could use mobile learning without the support of a technical person.
I found the various functions in mobile learning were well integrated.
I thought there was a lot of consistency in mobile learning.
I would image that most people would learn to use mobile learning very quickly.
I found mobile learning very intuitive.
I felt very confident using mobile learning.
I could use mobile learning without having to learn anything new.

7 To which gender identity do you most identify?
Male (1)
Female (2)
Transgender female (3)
Transgender male (4)
Gender variant/non-conforming (5)
Not listed (6)
Prefer not to answer (7)

8 I am a(n)
Undergraduate student (1)
Graduate student (2)

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If I am a(n) = Undergraduate student

9 What is your level?
Freshman (1)
Sophomore (2)
Junior (3)
Senior (4)

10 What is your age?
____

11 What is your major?
____

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APPENDIX C
Student Demographics Data Analysis

* See section 6 for a detailed discussion of Appendix C

Item	Frequency	Percentage (%)
Gender		
Male	19	46%
Female	20	48%
Transgender female	0	0%
Transgender male	1	#%
Gender variant/non-conforming	0	0%
Not listed	0	0%
Prefer not to answer	0	0%
No answer provided	1	3%
Degree level		
Undergraduate	32	78%
Graduate	8	19%
No answer provided	1	3%
Undergraduate Status		
Freshman	15	47
Sophomore	4	12
Junior	5	16
Senior	8	25

Table 1: Descriptive Statistics and Students Demographics (n=41)

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APPENDIX D
Faculty Demographics Data Analysis

* See section 5 for a detailed discussion of Appendix D

Item	Frequency	Percentage (%)
Gender		
Male	7	44%
Female	9	56%
Transgender female	0	0%
Transgender male	0	0%
Gender variant/non-conforming	0	0%
Not listed	0	0%
Prefer not to respond	0	0%
No answer provided	0	0%
Age		
20-29	0	0%
30-39	2	13%
40-49	5	31%
50-59	6	37%
60-69	2	13%
70-79	1	6%
80 and Over	0	0%
No answer provided	0	0%
Academic Rank		
Lecturer	0	
Instructor	4	25%
Assistant Professor	4	25%
Associate Professor	5	31%
Professor	1	6%
Emeritus	0	0%
Other	2	13%
No answer provided	0	0%
Highest Education Level		
Master's	3	19%
Doctorate	13	81%
Professional Degree	0	0%
Other	0	0%
No answer provided	0	0%
Program/area discipline		
Information Systems	0	0%

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Item	Frequency	Percentage (%)
Business	0	0%
Computer Science	0	0%
Other	16	100%
No answer provided	0	0%
College level – teaching		
Undergraduate	16	100%
Graduate	0	0%
Both graduate & undergraduate	0	0%
No answer provided	0	0%
Teaching location		
On-campus	4	25%
Online	0	0%
Hybrid	1	6%
On-campus and off-campus	3	19%
On and off-campus, hybrid	3	19%
On-campus and hybrid	5	31%
No answer provided	0	0%
Hiring status		
Full-time	12	75$
Part-time	4	25%
No answer provided	0	0%
Affiliation		
Public	15	94%
Private	1	6%
No answer provided	0	0%
Tenure Status		
Tenured	6	38%
Tenure-track	0	0%
Not on tenure-track``	10	62%
Tenure not available	0	0%
No answer provided	0	0%

Table 1: Descriptive Statistics and Faculty Demographics (n=16)

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APPENDIX E
Pre-Pandemic Faculty Data Analysis

* See section 5 for a detailed discussion of Appendix E.

Mahalanobis Distance Extreme Values

			Case Number	ID	Value
Mahalanobis Distance	Highest	1	72	327	62.86193
		2	63	293	58.91649
		3	27	156	56.92469
		4	25	148	55.40059
		5	60	267	51.72009
	Lowest	1	61	268	4.18849
		2	77	338	4.81146
		3	80	349	5.26834
		4	65	305	6.28024
		5	40	195	6.63620

Figure 1: Mahalanobis Distance Extreme Values

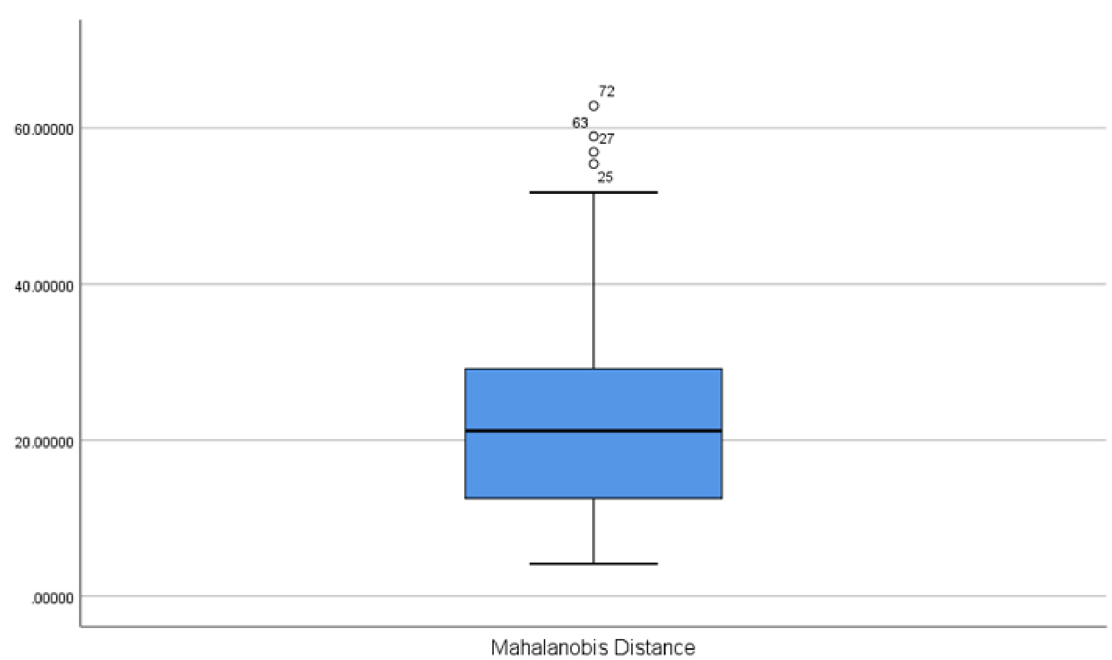

Figure 2: Mahalanobis Distance Results

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```
Mahalanobis Distance Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

    14.00        0 .  44566777888999
    25.00        1 .  0001111133344555677789999
    27.00        2 .  011111233333344556677777789
     7.00        3 .  0223469
     8.00        4 .  00114457
     2.00        5 .  11
     4.00 Extremes    (>=55)

 Stem width:  10.00000
 Each leaf:        1 case(s)
```

Figure 3: Mahalanobis Distance Stem-and-Leaf Plot

Internal Consistency

Construct	Composite reliability	Cronbach's alpha	Number of items
MISU	0.965	0.917	7
PE	0.960	0.945	4
PI	0.893	0.841	4
PP	0.892	0.873	5
PU	0.920	0.886	4

Table 2: Internal Consistency

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Convergent Validity

Construct	Indicator	Outer Loading	Indicator Reliability	AVE	AVE if Indicator is deleted	Cronbach's Alpha	Cronbach's Alpha if item is deleted
Mobile Information Systems Use	MISU1	0.965	0.931				0.907
	MISU2	0.986	0.972				0.906
	MISU3	0.986	0.972				0.906
	MISU4	0.964	0.929				0.905
	MISU5	0.986	0.972	0.841		0.917	0.906
	MISU6	0.991	0.982				0.906
	MISU7	**-0.358**	**0.128**		**0.969**		**0.919**
Perceived Enjoyment	PE1	0.963	0.927				0.903
	PE2	0.964	0.929				0.903
	PE3	0.923	0.852	0.859		0.945	0.905
	PE4	0.851	0.724				0.904
Personal Innovativeness	PI1	0.837	0.701				0.907
	PI2	0.788	0.621				0.908
	PI3	0.792	0.627			0.841	0.910
	PI4	0.869	0.755	0.676			0.907
Perceived Playfulness	PP1	**0.641**	**0.411**		**0.690**		**0.912**
	PP2	**0.495**	**0.245**		**0.733**		**0.912**
	PP3	0.865	0.748	0.636		0.873	0.905
	PP4	0.945	0.893				0.906
	PP5	0.940	0.884				0.904
Perceived Usefulness	PU1	0.767	0.588				0.908
	PU2	0.887	0.787	0.744		0.886	0.906
	PU3	0.866	0.750				0.906
	PU4	0.922	0.850				0.905

Table 3: Convergent Validity

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Indicator Cross Loadings

Construct	Indicator	MISU	PE	PI	PP	PU
MISU	MISU1	0.968	0.147	0.243	0.090	0.297
	MISU2	0.993	0.124	0.236	0.083	0.358
	MISU3	0.991	0.109	0.247	0.073	0.335
	MISU4	0.970	0.210	0.275	0.156	0.430
	MISU5	0.989	0.147	0.265	0.093	0.367
	MISU6	0.995	0.144	0.247	0.101	0.362
PE	PE1	0.157	0.963	0.527	0.714	0.478
	PE2	0.135	0.965	0.524	0.677	0.476
	PE3	0.073	0.923	0.455	0.676	0.361
	PE4	0.204	0.851	0.361	0.730	0.538
PI	PI1	0.286	0.461	0.837	0.272	0.341
	PI2	0.176	0.408	0.789	0.350	0.325
	PI3	0.145	0.306	0.791	0.186	0.192
	PI4	0.217	0.468	0.868	0.284	0.264
PP	PP3	0.072	0.793	0.268	0.861	0.503
	PP4	0.051	0..658	0.272	0.945	0.399
	PP5	0.140	0.643	0.376	0.945	0.450
PU	PU1	0.249	0.354	0.152	0.310	0.767
	PU2	0.304	0.469	0.305	0.436	0.886
	PU3	0.361	0.373	0.305	0.397	0.868
	PU4	0.338	0.500	0.394	0.509	0.921

Table 4: Indicator Cross Loadings

Fornell-Larcker criterion

	MISU	PE	PI	PP	PU
MISU	0.984				
PE	0.151	0.927			
PI	0.257	0.510	0.822		
PP	0.103	0.750	0.342	0.918	
PU	0.368	0.496	0.351	0.489	0.862

Table 5: Fornell-Larcker Criterion

Collinearity Assessment

Construct	Tolerance	VIF
PE	0.431	2.321
PI	0.799	1.251
PP	0.474	2.108
PU	0.709	1.411

Table 6: Collinearity Assessment

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Results of PLS Analysis

Structural Paths in Model	Sign	PLS Path Coefficient	t-statistic	*p*-value	Significance Level
H1a: PI → PU	+	0.351	3.172	0.002	**
H1b: PI → PE	+	0.510	5.769	0.000	***
H1c: PI → PP	+	0.342	4.706	0.000	***
H2a: PU → MISU	+	0.409	3.994	0.000	***
H2b: PE → MISU	+	0.048	0.270	***0.787***	***NS***
H2c: PP → MISU	-	-0.134	0.690	***0.490***	***NS***

*** $p < 0.05$**
**** $p < 0.01$**
***** $p < 0.001$**
NS - Not Significant

Table 7: Results of PLS Analysis

R^2 Values

	R^2	Predictive Accuracy
MISU	0.144	Weak
PE	0.261	Weak
PI	0.117	Weak
PP	0.123	Weak

Table 8: R^2 Values

f^2 Effect Size

	f^2	Effect
H1a: PI → PU	0.141	Small
H1b: PI → PE	0.352	Large
H1c: PI → PP	0.132	Medium
H2a: PU → MISU	0.141	Small
H2b: PE → MISU	**0.001**	No effect
H2c: PP → MISU	**0.009**	No effect

Table 9: f^2 Effect Size

Q^2 Values

	Q^2	Effect
MISU	0.124	Small
PE	0.203	Medium
PI	---	---
PP	0.087	Small
PU	0.080	Small

Table 10: Q^2 Values

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q^2 Effect size

	Q^2 included	Q^2 excluded	Predictive Relevance	Effect Size
PE	0.114	0.114	0.0000	Small
PU	0.114	0.017	0.1095	Small
PP	0.114	0.106	0.0090	Small

Table 11: q^2 Effect Size

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APPENDIX F
Mid-Pandemic Faculty Data Analysis

* See section 5 for a detailed discussion of Appendix F

			Case Number	Value
Mahalanobis Distance	Highest	1	1	14.06250
		2	16	14.06250
		3	2	14.06250
		4	12	14.06250
		5	7	14.06250
	Lowest	1	11	14.06250
		2	15	14.06250
		3	13	14.06250
		4	9	14.06250
		5	5	14.06250

Table 1: Mahalanobis Distance Extreme Value

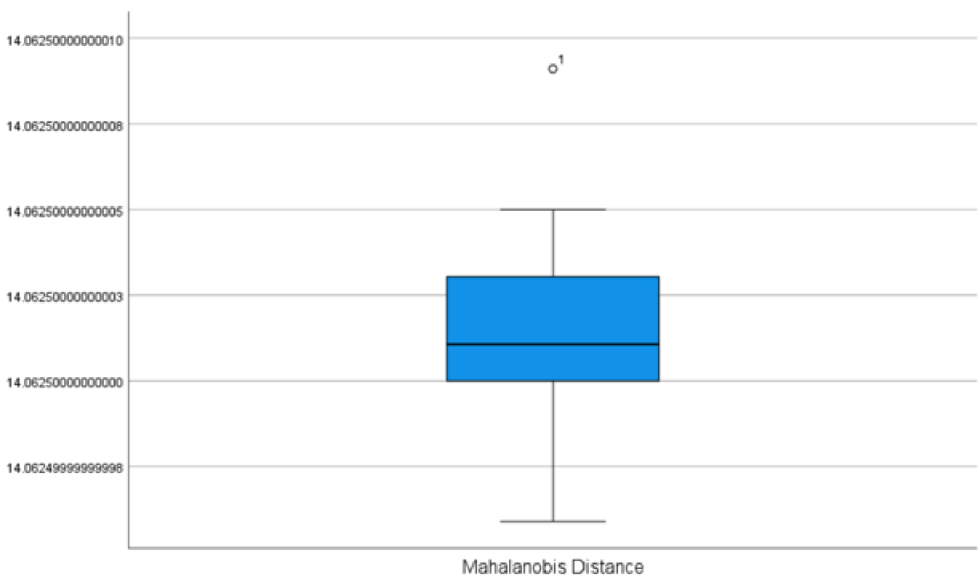

Figure 1: Mahalanobis Distance Results

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```
Mahalanobis Distance Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

      .00        9 .
     3.00        9 .  699
    11.00       10 .  00001112234
     1.00       10 .  5
     1.00 Extremes    (>=14.062500)

 Stem width:  1.0E-013
 Each leaf:        1 case(s)

 A constant of 14.06250 was
 extracted from the stems for clarity.
```

Figure 2: Mahalanobis Distance Stem-and-Leaf Plot

Internal consistency

Construct	Composite reliability	Cronbach's alpha	Number of items
MISU	0.962	0.938	7
PE	0.979	0.976	4
PI	0.961	0.954	4
PP	0.976	0.909	5
PU	0.964	0.939	4

Table 2: Internal Consistency

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Convergent Validity

Construct	Indicator	Outer Loading	Indicator Reliability	AVE	AVE if Indicator is deleted	Cronbach's Alpha	Cronbach's Alpha if item is deleted
Mobile Information Systems Use	MISU1	0.924	0.854	0.808	**0.943**	0.938	**0.967**
	MISU2	0.987	0.974				**0.966**
	MISU3	0.988	0.976				**0.966**
	MISU4	0.955	0.912				**0.966**
	MISU5	0.990	0.980				**0.966**
	MISU6	0.978	0.956				**0.966**
	MISU7	**0.044**	**0.002**				**0.976**
Perceived Enjoyment	PE1	0.950	0.903	0.934		0.976	0.967
	PE2	0.986	0.972				0.966
	PE3	0.973	0.947				0.967
	PE4	0.956	0.914				0.966
Personal Innovativeness	PI1	0.921	0.848	0.878		0.954	0.967
	PI2	0.927	0.859				0.967
	PI3	0.945	0.893				0.966
	PI4	0.953	0.908				0.966
Perceived Playfulness	PP1	**0.681**	**0.464**	0.735	**0.806**	0.909	**0.970**
	PP2	**0.697**	**0.486**		**0.808**		**0.969**
	PP3	0.953	0.908				**0.967**
	PP4	0.955	0.912				**0.967**
	PP5	0.951	0.904				**0.967**
Perceived Usefulness	PU1	0.921	0.848	0.846		0.939	
	PU2	0.924	0.854				
	PU3	0.867	0.752				
	PU4	0.965	0.931				

Table 3: Convergent Validity

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Indicator Cross Loadings

Construct	Indicator	MISU	PE	PI	PP	PU
MISU	MISU1	0.919	0.681	0.844	0.596	0.622
	MISU2	0.987	0.625	0.878	0.485	0.640
	MISU3	0.989	0.678	0.890	0.572	0.712
	MISU4	0.958	0.559	0.830	0.577	0.733
	MISU5	0.991	0.665	0.903	0.539	0.686
	MISU6	0.979	0.648	0.876	0.535	0.683
PE	PE1	0.579	0.950	0.678	0.789	0.669
	PE2	0.674	0.986	0.724	0.833	0.707
	PE3	0.636	0.973	0.687	0.810	0.746
	PE4	0.665	0.956	0.761	0.893	0.734
PI	PI1	0.776	0.647	0.922	0.586	0.604
	PI2	0.783	0.637	0.928	0.644	0.571
	PI3	0.924	0.747	0.945	0.732	0.736
	PI4	0.861	0.724	0.952	0.690	0.679
PP	PP3	0.489	0.866	0.607	0.948	0.780
	PP4	0.584	0.839	0.752	0.973	0.769
	PP5	0.562	0.803	0.695	0.982	0.819
PU	PU1	0.647	0.833	0.732	0.925	0.920
	PU2	0.571	0.514	0.495	0.636	0.924
	PU3	0.511	0.638	0.557	0.635	0.867
	PU4	0.793	0.696	0.725	0.760	0.965

Table 4: Indicator Cross Loadings

Fornell-Larcker Criterion

	MISU	PE	PI	PP	PU
MISU	0.971				
PE	0.662	0.966			
PI	0.897	0.739	0.937		
PP	0.566	0.862	0.712	0.968	
PU	0.700	0.740	0.696	0.815	0.920

Table 5: Fornell-Larcker Criterion

Collinearity Assessment

Construct	Tolerance	VIF
PE	0.284	3.525
PI	0.498	2.007
PP	0.250	3.993
PU	0.355	2.815

Table 6: Collinearity Assessment

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Results of PLS Analysis

Structural Paths in Model	Sign	PLS Path Coefficient	t-statistic	*p*-value	Significance Level
H1a: PI → PU	+	0.696	1.863	0.032	*
H1b: PI → PE	+	0.739	4.269	0.000	***
H1c: PI → PP	+	0.712	3.724	0.000	***
H2a: PU → MISU	+	0.645	1.602	***0.055***	***NS***
H2b: PE → MISU	+	0.584	1.333	***0.092***	***NS***
H2c: PP → MISU	-	-0.463	0.768	***0.221***	***NS***

*** $p < 0.05$**
**** $p < 0.01$**
***** $p < 0.001$**
NS - Not Significant

Table 7: Results of PLS Analysis

R^2 Values

	R^2	Predictive Accuracy
MISU	0.576	Moderate
PE	0.546	Moderate
PP	0.506	Moderate
PU	0.484	Moderate

Table 8: R^2 Values

f^2 Effect Size

	f^2	Effect
H1a: PI → PU	0.940	Large
H1b: PI → PE	1.201	Large
H1c: PI → PP	1.026	Large
H2a: PU → MISU	0.324	Medium
H2b: PE → MISU	0.204	Medium
H2c: PP → MISU	0.095	Small

Table 9: f^2 Effect Size

Q^2 Values

	Q^2	Effect
MISU	0.395	Large
PE	0.464	Large
PI	---	----
PP	0.426	Large
PU	0.038	Small

Table 10: Q^2 Values

q^2 Effect size

	Q^2 included	Q^2 excluded	Predictive Relevance	Effect Size
PE	0.395	0.284	0.1835	Medium
PU	0.395	0.286	0.1802	Medium
PP	0.395	0.339	0.0926	Small

Table 11: q^2 Effect Size

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APPENDIX G
Mid-Pandemic Student Data Analysis

* See section 6 for a detailed discussion of Appendix G

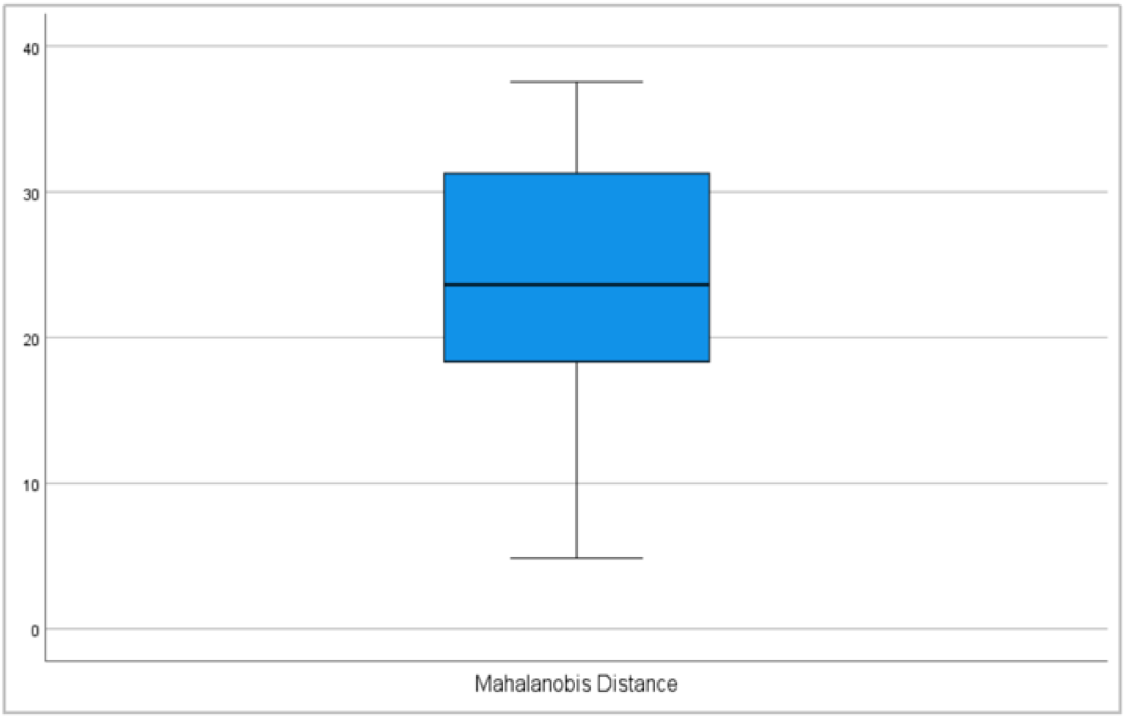

Figure 1: Mahalanobis Distance Results

```
Mahalanobis Distance Stem-and-Leaf Plot

 Frequency    Stem &  Leaf

     1.00        0 .  4
     4.00        0 .  5889
     3.00        1 .  124
     4.00        1 .  6688
    10.00        2 .  0001222234
     6.00        2 .  566788
    11.00        3 .  00112333334
     2.00        3 .  57

 Stem width:  10.00000
 Each leaf:        1 case(s)
```

Figure 2: Mahalanobis Distance Stem-and-Leaf Plot

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Internal consistency

Construct	Composite reliability	Cronbach's alpha	Number of items
MISU	0.951	0.836	7
PE	0.984	0.978	4
PI	0.855	0.822	4
PP	0.706	0.613	5
PU	0.976	0.967	4

Table 1: Internal Consistency

Convergent Validity

Construct	Indicator	Outer Loading	Indicator Reliability	AVE	AVE if Indicator is deleted	Cronbach's Alpha	Cronbach's Alpha if item is deleted
Mobile Information Systems Use	MISU1	0.879	0.773	0.827		0.836	0.923
	MISU2	0.931	0.867				0.922
	MISU3	0.974	0.949				0.921
	MISU4	0.899	0.808				0.921
	MISU5	0.941	0.855				0.923
	MISU6	0.964	0.929				0.921
	MISU7	**-0.760**	**0.578**		**0.876**		**0.939**
Perceived Enjoyment	PE1	0.961	0.924	0.938		0.978	0.919
	PE2	0.979	0.958				0.919
	PE3	0.973	0.947				0.918
	PE4	0.959	0.920				0.918
Personal Innovativeness	PI1	0.734	0.539	0.596		0.822	0.927
	PI2	0.727	0.529				0.928
	PI3	0.823	0.677				0.924
	PI4	0.799	0.638				0.925
Perceived Playfulness	PP1	**0.039**	**0.002**	0.538	**0.673**	0.613	**0.929**
	PP2	**-0.426**	**0.181**		**0.655**		**0.936**
	PP3	0.870	0.757				0.919
	PP4	0.942	0.887				0.917
	PP5	0.929	0.863				0.918
Perceived Usefulness	PU1	0.940	0.884	0.910		0.967	0.916
	PU2	0.957	0.916				0.916
	PU3	0.960	0.922				0.917
	PU4	0.959	0.920				0.917

Table 2: Convergent Validity

Indicator Cross Loadings

Construct	Indicator	MISU	PE	PI	PP	PU
MISU	MISU1	0.895	0.131	0.164	0.366	0.546
	MISU2	0.940	0.241	0.207	0.487	0.668
	MISU3	0.972	0.277	0.217	0.528	0.698
	MISU4	0.898	0.391	0.150	0.594	0.729
	MISU5	0.943	0.204	0.171	0.439	0.603
	MISU6	0.963	0.378	0.157	0.582	0.731
PE	PE1	0.254	0.961	0.378	0.789	0.702
	PE2	0.243	0.979	0.309	0.789	0.730
	PE3	0.269	0.973	0.384	0.863	0.767
	PE4	0.349	0.959	0.396	0.875	0.778
PI	PI1	0.142	0.071	0.735	0.180	0.123
	PI2	0.095	0.069	0.730	0.187	0.101
	PI3	0.103	0.526	0.822	0.370	0.355
	PI4	0.270	0.142	0.798	0.283	0.274
PP	PP3	0.276	0.936	0.298	0.898	0.767
	PP4	0.488	0.835	0.409	0.956	0.839
	PP5	0.640	0.705	0.329	0.939	0.857
PU	PU1	0.624	0.808	0.272	0.910	0.940
	PU2	0.678	0.755	0.328	0.844	0.957
	PU3	0.720	0.698	0.314	0.832	0.960
	PU4	0.684	0.693	0.372	0.808	0.959

Table 3: Indicator Cross Loadings

Fornell-Larcker criterion

	MISU	PE	PI	PP	PU
MISU	0.936				
PE	0.292	0.968			
PI	0.190	0.382	0.772		
PP	0.536	0.860	0.375	0.931	
PU	0.711	0.771	0.339	0.887	0.954

Table 4: Fornell-Larcker Criterion

Collinearity Assessment

Construct	Tolerance	VIF
PE	0.255	3.927
PI	0.816	1.255
PP	0.139	7.188
PU	0.211	4.748

Table 5: Collinearity Assessment

Results of PLS Analysis

Structural Paths in Model	Sign	PLS Path Coefficient	t-statistic	*p*-value	Significance Level
H1a: PI → PU	+	0.339	1.654	0.049	*
H1b: PI → PE	+	0.382	1.631	***0.052***	**NS**
H1c: PI → PP	+	0.375	2.003	0.023	*
H2a: PU → MISU	+	1.126	5.597	0.000	***
H2b: PE → MISU	-	-0.687	2.924	0.002	**
H2c: PP → MISU	+	0.128	0.529	***0.299***	**NS**

*** $p < 0.05$**
**** $p < 0.01$**
***** $p < 0.001$**
NS - Not Significant

Table 6: Results of PLS Analysis

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R^2 Values

	R^2	Predictive Accuracy
MISU	0.669	Moderate to Substantial
PE	0.146	Weak
PI	0.141	Weak
PP	0.115	Weak

Table 7: R^2 Values

f^2 Effect Size

	f^2	Effect
H1a: PI → PU	0.130	Medium
H1b: PI → PE	0.171	Medium
H1c: PI → PP	0.164	Medium
H2a: PU → MISU	0.818	Large
H2b: PE → MISU	0.371	Large
H2c: PP → MISU	0.007	Small

Table 8: f^2 Effect Size

Q^2 Values

	Q^2	Effect
MISU	0.564	Large
PE	0.128	Medium
PI	-----	-----
PP	0.105	Medium
PU	0.095	Medium

Table 9: Q^2 Values

q^2 Effect size

	Q^2 included	Q^2 excluded	Predictive Relevance	Effect Size
PE	0.564	0.452	0.2569	Medium to Large
PU	0.564	0.318	0.5642	Large
PP	0.564	0.563	0.0023	Medium

Table 10: q^2 Effect Size

APPENDIX H
Mid-Pandemic Faculty M-Learning Activities Usage

* See section 5 for a detailed discussion of Appendix H

Activity	Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Always
Email students	1	1	3	1	5	1	4
Email colleagues	1	1	3	0	6	1	4
Text students	5	4	2	4	0	0	1
Text colleagues	2	4	0	3	6	0	1
Post grades	3	3	2	3	2	0	3
Post to discussion board	3	3	3	6	1	0	0
Access course site	0	4	0	2	7	0	3
Access library resources	2	2	1	5	3	3	0
Access social networking	2	2	0	1	7	2	2
Order textbooks	7	2	2	2	1	1	1
Search internet	0	0	1	1	3	5	6
Provide tutoring services	6	5	1	3	1	0	0
Prepare lessons	4	1	2	4	1	2	2
Conduct seminars	7	2	1	4	0	2	0

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Activity	Never	Rarely	Occasionally	Sometimes	Frequently	Usually	Always
Collect content for coursework	2	2	2	4	2	2	2
Read eBooks	2	3	2	4	1	3	1
Take pictures or make videos for course	2	2	2	4	4	2	0
Other (please specify)	5	11	0	0	0	0	0

Table 1: Mobile Device Use for M-Learning Activities for Teaching