Sociodemographic Profile as Moderators in the Technology Acceptance of Productivity Applications

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***Abstract*—During the outbreak of COVID-19, the productivity gap between working in the office and at home has become a more critical issue in the labor market. For teachers with numerous vital responsibilities, the inescapable increased workload results in less productivity and efficiency. Following the reliance on productivity applications to lessen labor, we investigated the moderating effects of sociodemographic profiles of teachers through the Technology Acceptance Model. The demographic makeup of our participants (n = 513) was dominated by assistant professors, females, married, licensed teachers, aged 25 to 34 with a teaching experience of 6 to 10 years, and permanent and full-time in a public university. Our findings demonstrate that sociodemographic variables moderate the effects of perceived usefulness (PU) and perceived ease of use (PEOU) on teachers' behavioral intention to use (BITU), except for the effects of gender in PEOU ⟶ BITU, teaching experience in PEOU ⟶ BITU, and educational attainment in PU ⟶ BITU.**

Keywords—Teleworking, COVID-19, Productivity, Technology Acceptance Model, Sociodemographic, Software Application

I. Introduction

A recent policy brief of the United Nations asserted that the COVID-19 outbreak is the largest educational disruption in the history of mankind [1]. The severe consequences of the outbreak affected more than 190 countries with nearly 1.6 billion learners. In an effort to restrict the virus transmission, schools closed their gates and temporarily transferred to an online mode of teaching and learning (emergency remote education) [2, 3]. The negative experiences of parents, students, and teachers have been notable following this sudden transition [4-6]. During this time, parents struggled to accomplish their additional role as home teachers, especially since they are also preoccupied with their regular full-time jobs. It was contended that home-schooling was a grueling task for the parents [7]. For students, the psychological impacts of self-isolation and mobility restrictions not only affected their daily school activities but also their mental health condition. In other reports, students suffered loneliness, anxiety, depression, and stress symptoms as early as the first month of the enhanced community quarantine. Meanwhile, many teachers faced several challenges and restrictions that obstructed their capability to be effective in virtual classrooms. A systematic review realized that teachers struggled in resolving technical concerns, familiarizing online learning platforms, and conducting virtual classes [8]. In recent empirical works [9-12], the magnitude of these negative experiences and challenges was described in detail.

The occupational situation of teachers worldwide has turned out to be more intricate and laborious during emergency remote education when compared to face-to-face classroom teaching. In recent studies, a decline in productivity levels was reported [13, 14], stressing the importance for educational leaders to prioritize defusing this effect. Even before the pandemic, the relationship between productivity and an adequate working environment has already been recognized [15]. When teachers are provided with good working conditions, they can concentrate on their tasks and be more productive. The physical work environment has been a focal point of attention in numerous studies even pre-pandemic. However, their discoveries may not apply to the online working environment because a remote workplace demands dependence on technology (e.g., learning management systems, productivity applications, and video conferencing software). Throughout the pandemic, the benefits of productivity applications in managing daily work and increasing work productivity are more extensive. Schools are thereby investing in these technologies to assist their stakeholders. However, we still do not know the key antecedents influencing the intention to use productivity applications among teachers. In this study, we explored sociodemographic variables and their moderating effects using the Technology Acceptance Model (TAM) as our theoretical microscope [16].

II. Literature Review

A. Teleworking During the Pandemic

One of the foremost adjustments initiated by the COVID-19 outbreak was the accretion of a work-from-home setup [17]. It was also used in the education sector as teleworking seemed to be the only route to ensure the continuity of academic services. Teachers turned into teleworkers or those people who employed information and communications technologies to do their work at home. Prior studies have identified both negative and positive outcomes of working from home on productivity levels, based on various demographic and socioeconomic characteristics. For instance, several studies reported that women and those who are working in underpaid jobs experienced the highest productivity decline [18, 19]. As documented by prior works, the drawbacks of this work arrangement include social isolation, distractions, and costs. Thus, managers are also concerned about a possible reduction in productivity and efficiency [17]. This issue makes work productivity a crucial topic in educational research.

B. Work Productivity of Teachers

Teachers are entrusted with many vital responsibilities. The wide range of activities they need to accomplish daily demands a high productivity level. However, teachers perform numerous tasks that are beyond their job description, making it difficult to maintain their productivity. Further, the mandatory work-from-home arrangement is a setup that most teachers are not prepared for. They have to restructure their work routine to accommodate teleworking and teachers noted that they have more work hours during the pandemic era [20]. This untimely situation indicates that productivity applications are more valuable and useful than ever. Investing in these technologies may alleviate the negative effects of working from home. Nevertheless, the acceptance of these technologies has not yet been studied in detail.

C. Technology Acceptance Model

The acceptance and use of electronic means to accomplish a task is a pivotal research field and a significant interest across disciplines. Since its inception, TAM has been a popular theory for elucidating the technology acceptance and usage of different information systems by various kinds of users [21]. According to the first version of TAM [16], the primary factors that affect a person's behavioral intention to use (BITU) technologies are perceived usefulness (PU) and perceived ease of use (PEOU). The connection between PU and PEOU has also been described in many analyses. Accordingly, PEOU influences PU, resulting in increased BITU among users. Aside from these factors, there is also extensive literature that underscored the considerable influence of sociodemographic variables in TAM [22].

D. Moderating Effects of Demographic Variables

1) Gender as a Moderating Variable

Gender has been broadly used in TAM-related studies as a moderator to cognize the adoption of digital technologies. Prior works discovered that men and women are significantly distinct in making their decisions and they maintain unique cognitive structures [23]. In information system research, it was asserted that gender has a crucial role in predicting usage behavior [24, 25]. A unified view of user acceptance also showed that gender as a moderating factor significantly increased the explanatory power of TAM to 52% [26]. It also has a moderating influence on BITU through PEOU and PU. Thus, we hypothesize that the connections between TAM constructs are moderated by gender.

2) Age as a Moderating Variable

Prior research reveals that age is a substantial demographic variable that possesses moderating and direct effects on BITU and actual technology usage [24, 26, 27]. Accordingly, younger users are more inclined to use technology while older users tend to be fairly laid back since they feel that they are extremely old to learn [28]. In terms of computer anxiety, younger adults have lesser fear than their older counterparts, indicating that the latter are more reluctant to engage in new technologies [27, 29, 30]. Most prior works that assessed age as a moderator revealed the lack of exposure to technologies and their practical applications as a principal excuse. In this study, we propose that age will moderate the relationships between TAM constructs.

3) Educational Attainment as a Moderating Variable

The extent of and the highest level of formal education that individuals have achieved shape their technology adoption. It was learned that people with higher educational attainments are more comfortable with accepting and using technology [31]. In education, teachers pursue graduate studies to improve not only teaching competencies but also their technical understanding of their field. It is possible that as teachers become more informed, the more they become appreciative of how useful and easy-to-use technologies are as pedagogical tools. Thus, we hypothesize that educational attainment (bachelor's, master's, or doctorate) moderates the relationships between TAM constructs.

4) Teaching Experience as a Moderating Variable

The length of teaching experience has been recounted to be significantly correlated to the successful use of technologies in the classroom [32]. Teachers with longer experience are better implementors of learning technologies because they know what the best approaches are to teaching a particular topic. They have the advantage of being able to experiment with different lessons and procedures, which significantly increases their pedagogical and professional competencies. We argue that well-experienced teachers can better appraise technologies in terms of PEOU and PU. Therefore, we hypothesize that the teaching experience will moderate the effects of these TAM constructs on BITU.

5) Academic Rank as a Moderating Variable

The decision to adopt new technologies has been associated with the qualification that makes someone suitable for a job or position [33]. Previous works used educational background and length of experience to signify the qualifications, which are also part of our demographic variables. In the case of teachers, these accomplishments are not the extent of their qualifications. Their teaching credentials also include attending workshops, passing certifications, joining professional organizations, and speaking in seminars. These credentials often embody the academic rank (bachelor, master, and doctorate) of teachers, and we theorize it will moderate the relationships between TAM constructs.

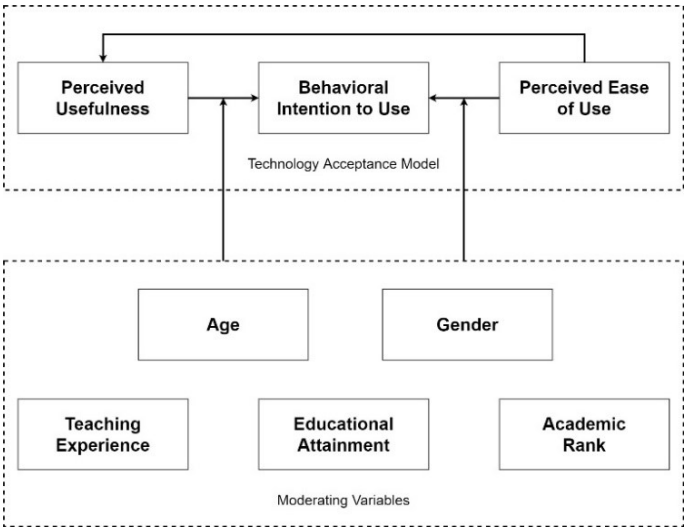

Fig. 1. Proposed Research Model with Hypothesized Paths.

III. Methodology

In this cross-sectional study, we utilized structural equation modeling (SEM) to create our theoretical framework describing the moderating effects of teachers' demographic characteristics on their intention to use online productivity applications. There have been numerous studies involving the SEM approach when investigating technology acceptance among teachers [34, 35]. SEM is a multivariate statistical analysis technique that assesses intricate relationships by analyzing the path coefficients of both direct and indirect effects [36]. For this study, we replicated the three-step approach utilized in the analysis of factors affecting the acceptance of learning management systems [37]. First, we formed a preliminary model based on TAM constructs and we determined the relationships according to our literature review. Then, we devised a questionnaire with three constructs (PEOU, PU, and BITU) for measuring the factors. We also assessed the measurement model using confirmatory factor analysis. Lastly, we configured the model one at a time to prevent unnecessary outcomes. Finally, we conducted this study in conformity with the professional and ethical principles of our institutions.

A. Instrument Development

We adopted our questionnaire from prior research that used the same constructs (i.e., PU, PEOU, and BITU) [37]. Since the items were constructed for a different technology, we modified them to indicate productivity applications. We invited teachers who have experience in research writing to evaluate the initial version of our questionnaire. Using a judgment approach, they examined the format, completeness, and readability. Feedback from this questionnaire analysis resulted in minor changes from altering existing statements to adding new items. We recruited another set of teachers to evaluate the reliability and validity of our revised questionnaire. Accordingly, all constructs received an acceptable Cronbach's alpha score (> 0.70), which indicates an internally consistent questionnaire. The final instrument has demographic information and a 5-point Likert scale for TAM.

B. Sample and Sampling Technique

Our intended population was professional teachers who were working during the COVID-19 outbreak in any basic or higher education institutions. Since participant recruitment was more difficult due to nationwide lockdowns, we mixed purposive and snowball sampling techniques. With insufficient responses from our online self-administered data collection between June 1 to 30, 2022 (n = 239), we then requested our colleagues from our professional network to assist in recruiting more teachers. We amassed a total of 513 responses after our second round of data collection, which ended on July 29 of the same year. In line with our target of securing external validity and enabling reasonable generalization, we ensured a representative sample by collecting data from the three major island groups of the country.

C. Data Analysis

We utilized IBM SPSS Statistics 22 and Amos 22 to analyze and report the results of our descriptive statistics and SEM. For testing our research hypotheses, we evaluated the connections between the latent variables and measurement items as our first step. Afterward, we analyzed the measurement model using the confirmatory factor analysis. Finally, we used SEM to establish the correlation and standardization coefficients for every factor. We utilized the suggested values for the goodness-of-fit (Table 3) to measure the resulting structural model [38].

TABLE I. Sociodemographic Characteristics of Teachers

Characteristics	f	%
Gender		
Male	225	43.86
Female	288	56.14
Age		
18 – 24	34	6.63
25 – 34	132	25.73
35 – 44	129	25.15
45 – 54	126	24.56
55 – 64	87	16.96
65 and over	5	0.97
Teaching Experience		
1 – 5	37	7.21
6 – 10	127	24.76
11 – 15	113	22.03
16 – 20	119	23.20
21 – 25	64	12.48
26 – 30	53	10.33
31 and above	12	2.34
Marital Status		
Single	223	43.47
Married	243	47.37
Divorced	0	0.00
Separated	8	1.56
Widowed	39	7.60
Academic Rank		
Basic Education – Teacher	119	23.20
Basic Education – Master Teacher	65	12.67
Basic Education – Head Teacher	12	2.34
Higher Education – Lecturer/Instructor	67	13.06
Higher Education – Assistant Professor	161	31.38
Higher Education – Associate Professor	89	17.35
Higher Education – Professor	23	4.48
Work Schedule		
Part-Time	124	24.17
Full-Time	389	75.83
Employment Status		
Permanent	321	62.57
Non-Permanent	192	37.43
Type of Institution		
Public	269	52.44
Private	244	47.56
Highest Educational Attainment		
Bachelor	123	23.98
Master	243	47.37
Doctorate	147	28.65
Licensed Professional Teacher		
Yes	302	58.87
No	211	41.13

IV. Results and Discussion

As shown in Table 1, most teachers were female (n = 288, 56.14%) and married (n = 243, 47.37%). Their age ranged from 25 to 34 years (n = 132, 25.73%; M = 29.37, SD = 9.42) with a teaching experience of six to ten years (n = 127, 24.76%; M = 8.84, SD = 6.32). They were permanent (n = 321, 62.57%) and full-time (n = 389, 75.83%) employed in a public university (n = 269, 52.44%) with an academic rank of assistant professor (n = 161, 31.38%). Most teachers were licensed professionals (n = 302, 58.87%) with a master's degree (n = 243, 47.37%). The demographic of our sample resembled previous research that likewise recruited Filipino teachers as study participants [6].

TABLE II. Descriptive Statistics of the TAM Constructs

Construct	Mean	Std. Dev.	Cronbach's Alpha
PU	4.44	.95	.92
PEOU	4.10	.97	.92
BITU	4.19	.96	.89

Table 2 presents the results of the descriptive analysis. The mean scores of constructs in our proposed model ranged from 4.10 (0.97) to 4.44 (0.95), indicating a positive response among teachers. They are appreciative of how useful and easy-to-use productivity applications are, and they intend to employ them in their work. Finally, Cronbach's alpha score ranged from 0.89 to 0.92, which indicates a reliable instrument (> 0.70).

TABLE III. Results of Structural and Measurement Models

Fit Index	Recommended Value	Structural Model	Measurement Model
χ^2/df	< 5 preferable < 3	2.57	2.68
TLI	> .95	.966	.959
CFI	> .90	.967	.956
RMSR	< .10	.091	.085
RMSEA	< .08	.051	.052

We performed a confirmatory factor analysis to investigate the interactions between the constructs of the conceptual model. To carry out this step, we used the maximum-likelihood method to evaluate the parameters of the model [39]. In this method, all analyses that we accomplished were according to the variance-covariance matrices. Following the suggested values shown in Table 3, we examined the model using the Chi-Square/Degree of Freedom (χ^2/df), Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), Root Mean Square Residuals (RMSR), and the Tucker-Lewis Index (TLI). Given the good measurement model, we then analyzed the reliability and validity to examine the model's psychometric properties.

TABLE IV. Inter-Construct Correlations

Construct	CR	AVE	PEOU	PU	BITU
PEOU	.839	.713	.844	-	-
PU	.926	.721	.636	.962	-
BITU	.901	.751	.655	.663	.949

As shown in Table 4, the composite reliability scores ranged from .839 to .926 which exceeded the suggested .70 threshold. This result means indicate that the questionnaire was internally consistent. Meanwhile, the average extracted variances were all above .50, indicating that convergent validity is not a problem. We also analyzed the discriminant validity and observed that the squared correlations between constructs were all less than the square root of average extracted variances.

TABLE V. Direct Effects Among TAM Constructs

Proposed Relationships	Path Coefficients	p-value	Result
PEOU (+) ⟶ PU	.253	.010	Supported
PU (+) ⟶ BITU	.382	.000	Supported
PEOU (+) ⟶ BITU	.314	.007	Supported

Table 5 shows the results of the path coefficients and direct effects among TAM constructs in the model. This analysis was merely a validation since the relationships between PEOU, PU, and BITU have been repeatedly established in the literature [26, 37]. As expected, PEOU positively influences PU (β = 0.253, p = 0.010) and BITU (β = 0.314, p = 0.007), and PU also affects BITU (β = 0.382, p = 0.000). Our findings support prior studies regarding the relationships between the TAM constructs.

TABLE VI. Moderating Effects of Demographic Variables

Proposed Relationships	Results
Gender × (PEOU, PU) ⟶ BITU	PEOU: 0.123 PU: 0.021
Age × (PEOU, PU) ⟶ BITU	PEOU: 0.015 PU: 0.012
Educational Attainment × (PEOU, PU) ⟶ BITU	PEOU: 0.043 PU: 0.169
Teaching Experience × (PEOU, PU) ⟶ BITU	PEOU: 0.141 PU: 0.045
Academic Rank × (PEOU, PU) ⟶ BITU	PEOU: 0.034 PU: 0.039

Note: The results presented are the path coefficients. * = Significant.

Table 6 exhibits the results of our analyses that investigated sociodemographic variables as moderators on the link between endogenous (BITU) and exogenous (PEOU and PU) constructs. Our results show that all sociodemographic variables moderate the effects of PU and PEOU on BITU, except for the influences of gender in PEOU → BITU, educational attainment in PU → BITU, and teaching experience in PEOU → BITU.

A. The Moderating Influence of Gender

Gender was found to influence the connection between PU and BITU (β = 0.356, p = 0.021), which was stronger for males. This finding contradicts previous studies where gender had no significant moderating influence on this relationship [26, 40]. It also indicates that male teachers are more concerned about the usefulness of a system before agreeing to use it. One reason that corroborates this contention is the fact that male teachers have more confidence and experience in using computers [41]. Thus, they are familiar with what to expect in a system.

B. The Moderating Influence of Age

Age was discovered to moderate PU ($\beta = 0.294$, $p = 0.012$) and PEOU ($\beta = 0.413$, $p = 0.015$) regarding the intention to use productivity applications. This finding is consistent with earlier studies that discovered the crucial role of age in the acceptance of technology [24, 27, 40]. In our analyses, we found a stronger relationship between PEOU and BITU for older teachers. This result indicates that ease of use was a salient factor because the older generation lacks a comfort level and is more reluctant to adopt new technologies. On the other hand, PU was stronger for younger teachers who utilize technologies more frequently than older teachers [42]. Thus, they have more experience with using various applications and are more innovative in teaching.

C. The Moderating Influence of Educational Attainment

Educational attainment moderates the relationship between BITU and PEOU ($\beta = 0.211$, $p = 0.043$) but not PU and BITU, according to our analyses. This finding indicates that teachers only use productivity applications as supplementary tools since they are more concerned with the intuitiveness of technology. In particular, highly-educated teachers value more the ease of use of productivity tools when choosing whether or not to use them in their work. Another supporting evidence is that the ease of use of productivty application positively influences teachers' attitudes towards the technology, which is also an antecedent of BITU and continuance intention in other studies [43].

D. The Moderating Influence of Teaching Experience

Teaching experience was observed to be a moderator in the relationship between PU and BITU ($\beta = 0.231$, $p = 0.045$). This finding echoes existing work where the length of experience in teaching is significantly correlated to successful technology use in the classroom [36]. More experienced teachers have greater liberty to shape instruction because they know what the proper approaches are to teaching a particular subject matter and what technology to use. Nevertheless, our analysis failed to establish the moderating effect of teaching experience in the relationship between PEOU and BITU. It may be the case that beginner and experienced teachers do not disagree in terms of the importance they place on how intuitive technologies are.

E. The Moderating Influence of Academic Rank

Academic rank was observed to moderate the relationships between PU and BITU ($\beta = 0.195$, $p = 0.039$) as well as PEOU and BITU ($\beta = 0.202$, $p = 0.034$). Comparable to the teaching experience, we found that teachers with higher academic ranks tend to value more the usefulness of technology before deciding to use it. We observed the same discovery with PEOU where high-ranking teachers value the ease of use of the system when choosing whether or not to use it, which is comparable to the results in the educational attainment variable. Conceivably, the more credentials teachers have (e.g., presenting at conferences, attending workshops and training, speaking in seminars, joining organizations, and passing certifications), the more they value and realize how useful and easy to use productivity applications are. Future researchers may determine which credentials drive the moderating influence of the academic rank variable.

V. Conclusion

In this study, we investigated sociodemographic profiles as moderators when deciding whether or not to utilize productivity applications while teachers are teleworking during the COVID-19 outbreak. As we anticipated, the usefulness and ease of use of productivity applications are crucial in predicting teachers' intention to use and integrate them into their workflow. We also found that the sociodemographic profile of teachers moderates the connections between TAM constructs, except for the effects of gender in PEOU ⟶ BITU, educational attainment in PU ⟶ BITU, and teaching experience in PEOU ⟶ BITU. With many institutions investing in their technological infrastructure, these findings may help educational leaders and administrators in the education sector in policy formulation and decision-making. It is also apparent that our discoveries are comparable to previous studies that used TAM in assessing the technology acceptance of teachers. Although, we acknowledge that our results are not entirely identical to earlier works. This deviation indicates that the sociodemographic profile of teachers has distinctive effects when it comes to their intention of using productivity tools.

Our study has some limitations that may be tackled in future research. First, we only used the main constructs of TAM (i.e., PU, PEOU, and BITU) although there are newer versions (e.g., TAM2 and TAM3) with additional variables (e.g., *Perceived Enjoyment, Result Demonstrability Subjective Norm*, *Objective Usability, Computer Self-Efficacy, Image, and Job Relevance*). Teachers may also have varying experiences and perceptions of using productivity applications depending on a specific tool or software. Finally, we acknowledge that conducting our study during a pandemic may have affected our results. Nevertheless, our study emphasizes that with the many vital responsibilities of teachers, they deserve all the support they can get to become more productive and efficient in their work.

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