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User acceptance of the gender and development mobile app with a rating checklist using a modified technology acceptance model

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ABSTRACT

Resource centers of gender and development (GAD) in local government use the traditional method of disseminating information about GAD awareness, such as distributing printed campaign materials and conducting gender sensitivity training (GST) on faculty and staff, students, and selected barangay communities in the Philippines. Some recipients of campaign materials are text-heavy and unappealing to read, which makes them less interested. However, faculty and students conducting research are not aware if their study is gender-responsive or if GAD is invisible. Hence, this study examines the user acceptance of the GAD app mobile application using the modified technology acceptance model (TAM) with a machine learning (ML) algorithm applied. The results of statistics and analyses from the intended users (N=100) were presented including data-driven modeling using a support vector machine (SVM) to show precise findings for the research on how this technology was used and accepted. The study's findings show widespread acceptance among experts and users of the mobile application employing external factors like self-efficacy (SE) and specific anxiety (SA) and moderating variables such as age, sex, highest educational attainment (HEA), and knowledge in GAD implementation, which are crucial for predicting and understanding the consequences of the research made clear.

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1. INTRODUCTION

The Philippines' commitment to the Convention on the Elimination of All Forms of Discrimination Against Women (CEDAW) and the 1995 Beijing Platform For Action (BPFA) is essential in fostering gender sensitivity and awareness. More significantly, this commitment has been instrumental in shaping national frameworks for gender-related policies, standards, and guidelines [1] as a way of life for the Philippines [2], [3] which was also ordered by the Commission on Higher Education (CHED) Memorandum Order No.01 series of 2015 [4]. The gender and development (GAD) unit uses the traditional method of disseminating information about GAD awareness such as the distribution of printed campaign materials and conducting gender sensitivity training (GST) on faculty and staff, students, and selected barangay communities to assess their knowledge in GAD. Some receivers of campaign materials are not too interested because not attractive to read due to the text-heavy format. The academe and students who are conducting research are not aware if

their study is gender-responsive or GAD is invisible in the proposed project or study. Hence, the GAD app is a mobile-based technology developed by my co-developer from the Bachelor of Science in Information Technology (BSIT) students to showcase GAD awareness and disciplines. The latter is characterized as a wireless computing device that is portable and tiny enough to be operated with one hand [5]. By integrating both technical and social elements, the GAD app seeks to educate the general public, including men, women, senior citizens, children, and persons with disabilities (PWDs), ensuring that everyone, regardless of age or gender, has an equal understanding of GAD, which emphasize disciplines, laws, and mandates. In the process of adopting technology, numerous models and frameworks have been developed to describe how users adopt new technologies. These models employ Davis' (1989) existing (old) theory to incorporate aspects that can affect user acceptance using the technology acceptance model (TAM) [6]–[8].

This study intends to investigate the intention of using a mobile application for GAD awareness and discipline based on the theory of the TAM. This demonstrates the apparent need to acknowledge the important role of IT in modern education and suggests a paradigm for assessing IT adoption that combines TAM and social cognitive theory (SCT) by the end-users based on their age, sex, highest educational attainment, and knowledge of the GAD implementation on their workplace. It was designed especially to forecast who is most likely to embrace new technology in a professional setting. Over the past few decades, numerous theories of technology acceptance have been put up and developed in the literature on information systems research [7]–[9] including our research output [10]. While earlier studies have only explored the variables' use of TAM, they have not explicitly addressed the influence of applying external variables through SCT with moderating variables by analyzing behavioral intent (BI) on the actual use. According to the concept, a number of factors, most notably perceived usefulness (PU) and perceived ease of use (PEU), affect consumers' decisions about how and when to adopt new technology [11]. TAM consists of two sides, PU and PEU make up the first set of so-called beliefs, while attitude, behavioral intention to use, and actual usage behavior make up the second set [7]. TAM shows how users' attitudes, objectives, or intentions, as well as how the system is used, relate to their faith and beliefs (usefulness and ease of use). The degree to which a person thinks that using a system in particular will enhance its performance is known as PU. Additionally, PEU is the extent to which an individual thinks that using the system in particular will result in a business field [3], [12], [13]. SCT is one of the most powerful theories of human behavior. The important role that information technology plays in contemporary education suggests a paradigm for assessing IT acceptance that combines SCT and theory of action TAM [7]. This theory of learning is predicated on the notion that people pick up knowledge by seeing what other people do in the context of social interactions and experiences. In the context of computer use, certain literary works extended and applied SCT to promote technology acceptance [7], [14]. Four components make up the SCT, such as affect, SA, self-efficacy (SE), and outcome expectations [4], [5]. The research's design incorporates concepts from SCT in addition to those from Davis' TAM.

Furthermore, while data analytics provides end users with access to an organization's information without requiring direct information technology (IT) support, it also refers to the ideas, technologies, tools, and procedures that provide in-depth analysis and the discovery of actionable insight into data [15]. The traditional benchmark statistical techniques, including regression, analysis of variance, and principal component analysis, are used in a wide range of applications [16] as a kernel-based machine learning (ML) model for regression and classification tasks [17]. Support vector machines (SVM) have recently attracted the attention of data mining, pattern recognition, and ML communities because of their remarkable capacity for discrimination, optimal solution, and generalization. SVM has demonstrated efficacy in addressing practical binary classification problems [16], [18], [19]. There are studies presenting user acceptance exploring user attitudes and behavioral intentions towards using different fields of interest used as augmented reality [20], immersive technology [12], IoT [21], different mobile applications used for education [22], bank [23] and health fields [13], [24].

The main objective is to understand the factors affecting acceptance of the mobile application for GAD with a rating checklist using the modified TAM. Some parts of the objective such as designing a new TAM-based model with external factors affecting the acceptance of the said technology with moderating variables, formulating hypotheses of the study designs based on the TAM with external factors and moderating variables, and evaluating user acceptance based on the result of the survey questionnaire with a data-driven model using a ML algorithm. Lastly, the study aims to interpret the potential acceptability of the technology.

2. METHOD

The constructed research framework for the acceptance of the system, which draws on an extensive body of literature related to technology acceptance, was explained based on the adapted various constructs from the intention-attitude models that were originally developed in the psychology and information sciences

disciplines. The research methods are clearly presented in this section by identifying the predictors and hypothesis, identifying external factors from SCT that have been merged with the original TAM, and the formulated equation for a data-driven model used for technology acceptance through moderating variables such as age, sex, highest educational attainment, and knowledge on GAD.

2.1. Research model and hypotheses

The constructed model shown in Figure 1 is adapted from previous studies and focuses on emphasizing the H7 connection on the significant influence between the BI towards using the GAD app on actual system use, correlated with the moderating variables used in the study. The survey instrument was modified to meet the technological acceptance of the GAD app setting of this study based on factors that were validated in Davis [7], [25]. The collected ordinal data were used for the experiment. A 5-point Likert scale, ranging from "strongly agree" to "strongly disagree," was used to assess each questionnaire item. The following are the research variables used in the study shown in Table 1.

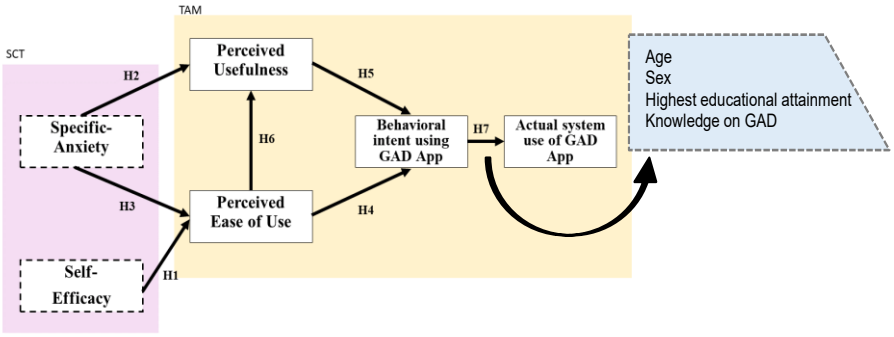

Figure 1. A new acceptance model for the GAD app adopted from TAM and SCT, with moderating variables

Table 1. List of variables

Variable	Items
Perceived usefulness (PU)	4
Perceived ease of Use (PEU)	4
Behavioral intent (BI)	4
Actual system use (ASU)	4
Specific-anxiety (SA)	4
Self-efficacy (SE)	4

The study's hypotheses were developed utilizing the TAM model as a foundation and the SCT model to account for external factors.

H1: SE has a positive influence on PEU of the GAD app.

The GAD app SE in this study is characterized as the individual's confidence in utilizing this mobile application. The survey questions for this dimension will seek to determine how respondents feel about their level of application-using their proficiency.

H2: SA has a negative influence on the PU of the GAD app.

H3: SA has a negative influence on the PEU of the GAD app.

The constant use of technology can have adverse effects, some of which include strong, negative emotional states. Some studies define SA as a mental condition characterized by feelings of fear or unease when using or thinking about the system [7]. This study defines SA as an individual's relationship with using the GAD app, encompassing any associated emotion or tendency that they adopt during their childhood [26] or in a self-administered current situation [27], [28]. The survey questions for this dimension will try to determine how comfortable or experienced respondents are with the application.

H4: PEU has a positive influence on BI toward using the GAD app.

H5: PU has a positive influence on BI toward using the GAD app.

H6: PEU has a positive influence on PU.

H7: BI towards using the GAD app has a positive influence on actual system use of GAD app.

The formulated equation with H7 to the moderating variable using a data-driven model for technology acceptance is shown belsow. Training an SVM requires a set of n examples. For reasons of

visualization, it will consider the case of a two-dimensional input, the x ∈R^2 that represents BI and CSU. Each sample consists of a pair, an input vector *xi*, and the associated label *yi*. Assume that a training set X is given as,

$$(x_1, y_J), (x_2, y_2) \cdots (x_n, y_n) \text{ where } x_1 \in R^d and\ y_1 \in (+1, -1) \quad (1)$$

2.2. Original factors used in the TAM model

PU is the degree to which a prospective user thinks using the GAD app would increase their productivity [29]. PEU is an element of PU. The rationale is that, under normal circumstances, consumers find a system more beneficial when it requires less work. This factor is also called effort expectancy because the user learns how to use the GAD app more easily than before [7]. The motivational elements that impact a particular activity are referred to as BI, and the more strongly one intends to carry out the behavior, the more probable it is to be carried out upon the real use of the GAD app which is greatly influenced by the BI to use them for information provision [5], [14], [30]. The current implementation of the new technology that supports the creation of the GAD app is known as the actual system used (ASU). The specific SE and SA that are selected for this study apply to SCTs among the four elements of the SCT paradigm. The study's primary objective is to facilitate the expansion of the suggested framework to incorporate the adoption and utilization of the GAD app. Therefore, in accordance with the previous implementation of TAM in the working scenario setting, the outcome expectations and affect components from SCT were removed.

2.3. Data-driven model for technology acceptance

To experimentally forecast end users' adoption of the GAD app, this research develops a novel data-driven methodology that makes use of ML and predictive analytics-based modeling. Furthermore, predictive analytics has several benefits, including the ability to examine and confirm hypotheses, as well as assess their applicability and predicted accuracy. More significantly, predictive analytics may bridge the gap between theory and reality because it is a data-driven methodology [31]. Through SVM, partial training and testing were presented to optimize the expected solution through the accuracy of using the moderating variables. Various tests have been conducted to perform regression analysis with data-driven applications.

2.4. Participants' demographics and data collection

This study was subjected to inspect the use intention of the GAD app based on the modified model. This study applies random sampling to the selection of the participants. Table 2 shows the number of participants based on age range, sex, highest educational attainment (HEA), and knowledge level on GAD needed to assess the GAD app through a survey instrument via Google Forms.

This study involves participants with experience in using mobile applications in any related activities, with different roles in the organization, and with knowledge of GAD implementation. The dataset collected was used in data analysis. The Philippine Law on Data Privacy Act of 2012 was discussed with the participants before they consented to answering the survey questionnaire with data collection consent after using the GAD app.

Table 2. Categories of participants (N=100)

Participants	Frequency
GAD coordinators and alternate	10
Technical experts	5
GAD advocates in LGU, DepEd, DoH	50
University employees	10
Student/faculty researchers	25

3. RESULTS AND DISCUSSION

This section contains the summary of the results of all statistical analyses, the demographics profile of the participants, and data analysis conducted to have data-driven modeling based on the methodologies and aims. The selection of hypotheses was predicated on characteristics, circumstances, issues, and other elements that were discovered in the literature to be pertinent to the analysis of the elements influencing the user acceptability of the GAD app in the future.

3.1. Demographic profile history

The demographic summary of the participants (N=100) of the study presents the user's knowledge of GAD by sex, age range, and HEA shown in Figure 2. The total of participants was assessed by age and

sex, the count of females (n=27) and males (n=12) were advanced beginners (n=39), and females (n=36) and males (n=11) were at the proficient level (n=47) respectively, with majority age range to 18 to 39 or young adults. The HEA shows that the tertiary degree/with units (n=47) appear most often, as a master's degree/with units (n=20), and doctoral degree/with units (n=18) respectively.

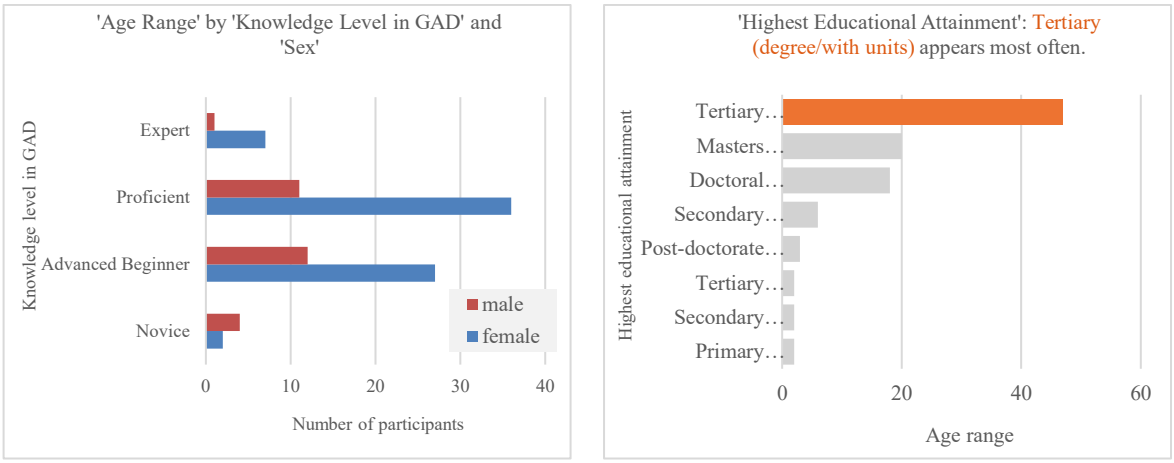

Figure 2. Demographic profile by moderating variables

3.2. Statistics and analyses

The analysis tool is very important to incorporate into the research method to measure and give a factual interpretation of each result of testing and training procedures on the pre-processed dataset. The open-source and user-friendly statistical software called JASP has been used in data modeling. The findings of all statistics and analyses based on the study's methodology and objectives are covered in this part. The results of the study are interpreted using a variety of statistics, including descriptive statistics, reliability constructs, correlation matrices, and analysis of the given hypotheses.

3.2.1. Frequentist scale reliability statistics

Developed by Lee Cronbach in 1951, Cronbach's alpha, often known as coefficient alpha or α, is a measure of internal consistency or reliability. The ability of a test or survey to measure what it is intended to evaluate is known as internal consistency reliability [32], [33]. A reliability test or internal accuracy checker is used to determine the accuracy of Likert multi-question surveys. Table 3 displays the results, which demonstrate that the BI, ASU, SA, and SE had $\alpha \geq 0.9$, indicating excellent questionnaire consistency, whereas the remaining items PU and PEU had less than $0.9 > \alpha \geq 0.8$, showing good construct consistency.

Table 3. Reliability construct

Variable	Cronbach's α	Items
PU	0.85	4
PEU	0.861	4
BI	0.935	4
ASU	0.914	4
SA	0.916	4
SE	0.954	4

3.2.2. Descriptive statistics

The factors utilized to interpret the study's findings are shown in Table 4 as descriptive statistics. The 24-item questions have a minimum value of 1, which indicates strongly disagree remarks, for the Perceivedease3, Perceivedease4, BehavioralIntent1, BehavioralIntent 3, BehavioralIntent 4, and Specific-anxiety1 items on the list. These items also have a maximum value of 5, indicating strongly agree remarks, with no missing values.

Table 4. Descriptive statistics

	Valid	Missing	Mean	Std. Deviation	MIN	MAX
Perceiveduse1	100	0	4.73	0.468	3	5
Perceiveduse2	100	0	4.8	0.426	3	5
Perceiveduse3	100	0	4.73	0.468	3	5
Perceiveduse4	100	0	4.69	0.526	2	5
Perceivedease1	100	0	4.57	0.59	3	5
Perceivedease2	100	0	4.58	0.606	3	5
Perceivedease3	100	0	4.55	0.702	1	5
Perceivedease4	100	0	4.61	0.737	1	5
BehavioralIntent1	100	0	4.53	0.758	1	5
BehavioralIntent2	100	0	4.61	0.68	2	5
BehavioralIntent3	100	0	4.57	0.756	1	5
BehavioralIntent4	100	0	4.65	0.744	1	5
ActualUsage1	100	0	4.53	0.717	2	5
ActualUsage2	100	0	4.66	0.607	2	5
ActualUsage3	100	0	4.59	0.637	2	5
ActualUsage4	100	0	4.58	0.684	2	5
Specific-anxiety1	100	0	4.57	0.655	1	5
Specific-anxiety2	100	0	4.51	0.643	2	5
Specific-anxiety3	100	0	4.43	0.655	2	5
Specific-anxiety4	100	0	4.53	0.674	2	5
Self-efficacy1	100	0	4.59	0.637	2	5
Self-efficacy2	100	0	4.61	0.68	2	5
Self-efficacy3	100	0	4.62	0.678	2	5
Self-efficacy4	100	0	4.62	0.678	2	5

3.2.3. Correlation analysis

Compared with other papers, the positive and negative data are classified as valid, and the correlation of all related variables identified the significant relationships between all of the constructs. Since the p-value of 0.001 is below the significance level ($p<0.01$), the study concluded that all indicators, including PU, PEU, BI, ASU, SA, and SE, correlate and have a significant correlation. It shows that each of the criteria has a close relationship with the other. Additionally, Table 5 displays the correlation analysis of the hypothesis based on the applied model. To forecast the link between the specified variables, a multiple regression analysis was conducted. $F(6, 95)=p<0005$ was statistically substantially predicted by these variables. It said that a p-value of.001 supported the equivalent interpretation of each hypothesis.

Table 5. Correlation analysis of the hypotheses

Hypotheses and statement	Path	Pearson r Correlation	P-value	Result
H1: Self-efficacy has a positive influence on the perceived ease of use of GAD app	SE→PEU	0.746	.001	Supported
H2: Specific anxiety has a negative influence on the perceived usefulness of the GAD app	SA→PU	0.709	.001	Supported
H3: Specific anxiety has a negative influence on the perceived ease of use of the GAD app	SA→PEU	0.508	.001	Supported
H4: Perceived ease of use has a positive influence on behavioral intent towards using the GAD app	PEU→BI	0.733	.001	Supported
H5: Perceived usefulness has a positive influence on behavioral intent towards using the GAD app	PU→BI	0.785	.001	Supported
H6: Perceived ease of use has a positive influence on perceived usefulness.	PEU→PU	0.812	.001	Supported
H7: Behavioral intent towards using the GAD app has a positive influence on actual system use of the GAD app	BI→ASU	0.678	.001	Supported

3.3. Data-driven model using SVM

After data preprocessing and accessing correlation analyses, the next step is to experiment using the SVM algorithm without optimization by utilizing the validation method to separate the data into training and testing sets [34]. This will give a predicted value on the concluded dataset affecting BI and ASU variables by incorporating the moderating variables. This study examines how predictive analytics might improve TAM by reviewing existing frameworks, introducing new elements, and assessing predictive power, which assessed the SVM classifications of moderating variables used in Table 6. In order to improve the SVM algorithm's capacity for generalization, its goal is to enhance the margin between the hyperplane and the closest data points. We refer to these sites as support vectors [35].

Table 6. Support vector machine classification

Moderating variable	Support vectors	n(Train)	n(Test)	Test accuracy (%)
Age	49	80	20	75
Sex	47	80	20	80
HEA	59	80	20	45
Knowledge level in GAD	78	80	20	55

The number of support vectors depends on how much slack we allow and the distribution of the data, wherein a large amount of slack will have many support vectors that show the data points (observations) that lie closest to the decision boundary. The slacks are only used in the training stage, but not in the test phase. In order to train an SVM and produce support vectors, an optimization issue involving quadratic programming must be solved, which presents a computing challenge as the number of training samples, *n*, is specified [36]. Based on the results, after running the SVM through the main variables used in TAM, female participants are the main contributors in the survey experiments that acquired 80% accuracy with SVM. 47 in the sex variable. Moreover, most of the age range of participants was from 18-39 or young adults with *sv.* 49 showing 75% accuracy. The findings also assessed the participants'/users' knowledge of GAD, with 55% accuracy showing the highest *sv* of 78. This shows that the higher support vector value is given from the training data, showing data points that are closer to the decision boundary, that many of the participants have direct knowledge in GAD that relates through the acceptance of the mobile application containing disciplines and information.

4. CONCLUSION

This research concluded all findings and evidence that this phenomenon is associated with increased knowledge of embracing the new technology for disseminating awareness on GAD through user acceptance. Further, this may advance our knowledge of how to use this technology as a stand-alone information source about GAD. The newly designed TAM-based model with external factors for the acceptance of the GAD app with moderating variables such as age, sex, HEA, and knowledge of GAD implementation in their environment found that the locals are willing to utilize the said technology over the behavioral intentions of the users to adopt the GAD app in actual use scenario. The concluded dataset about the user acceptance from the conducted survey questionnaire after using the GAD app gave the factual results and findings through statistics and analyses provided with a data-driven model via using the ML approach through SVM. The holistic interpretation of the potential acceptability of the technology is given and proven after a series of pre-processing, training, and testing of data that gave meaningful results that the acceptance of the GAD app will be used also as an information, education, and communication (IEC) material for GST in the future. Furthermore, for potential Intellectual Property, the study would have the potential to apply a copyright application to software, publication of the manuscript, and a patent application for a process model. Despite the contributions of this study, it is also not free from limitations. This study explored a comprehensive experiment with a data-driven approach. However, further and in-depth studies may be needed to recommend gathering data with a large number of respondents to better understand user acceptance through the unified theory of acceptance and use of technology (UTAUT). Another, this also needs to understand the insights of participants, through a qualitative study to provide a holistic view of GAD app adoption and make this study the baseline for future works as a supplier of GAD information. Lastly, a comparison of different ML algorithms may be used to compare different data-driven models for this study.

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AUTHOR CONTRIBUTIONS STATEMENT

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C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

DATA AVAILABILITY

Data availability is not applicable to this paper as no new data were created or analyzed in this study.

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