Predicting the actual use of social media sites among university communicators: using PLS-SEM and ML approaches

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Abstract

Studies on the acceptance of social media apps are being conducted at an increasing rate. The factors influencing its popularity for learning reasons are still not well understood, though. The goal of this study is to create a conceptual model that extends the Technology Adoption Model (TAM) to account for perceived playfulness to gauge students' acceptance of social media in learning. A total of 623 authenticated questionnaire surveys were obtained from students enrolled at a reputed university in the United Arab Emirates (UAE). Tools such as partial least squares-structural equation modeling (PLS-SEM) and machine learning approaches were obtained to examine the collected data. According to the research findings, significant parameters of students' intention to use social media networks for education include perceived playfulness, perceived usefulness, and perceived ease of use.

Keywords: Social media networks; Acceptance; Technology Acceptance Model; PLS-SEM.

1. Introduction

A social network is an online community where members share their photos, news, videos, and events to bring together their shared opinions, interests, experiences, and activities [1], [2], [11], [12], [3]–[10]. Users can communicate with one another on the internet via email and instant chat through these online communities [7], [8], [13]–[17]. Facebook is a social media networking platform that was created with college students in mind. On Facebook, users build profiles for themselves and add images, videos, and personal information [15]. Facebook is a one-way communication tool that is effective for sharing information [18]. Additionally, it enables students to work remotely with their classmates [10], [15], [18]–[22].

Users may also join Facebook groups, where participants do not need to be close friends [23]–[25]. These groups' members have free access to instantaneous article link sharing. They can share information or upload files and videos [7]. The widespread usage of social media is largely due to technological developments, such as the expansion of broadband service availability, improved

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software tools, and the creation of more robust computers and mobile phones [8]. In truth, this type of media has spread widely and has become a crucial component of the daily lives of many people across the globe [10].

Since instructors and students make up most internet users, social media appears to have had a significant role in how we teach and learn through these innovations [26], [27]. Social media adoption is currently in scarce supply [28]. The increasing effect of social media acceptance in education might be impacted by several factors [29]. Finding these factors continues to be difficult and varies from one nation to the next. Thus, the main goal of this study is to ascertain if there is a trend in students' acceptance of social media in the United Arab Emirates (UAE) or not.

According to the body of current literature, there has been little empirical research on how social media is utilized in UAE institutions, and little is known about the factors that influence students' actual use. Many technology acceptance studies typically analyze the theoretical models using the structural equation modeling (SEM) methodology. Consequently, this study's goal is two-fold. First, to utilize TAM [12] and the perceived playfulness construct to look at students' actual use of social media. Secondly, to use PLS-SEM and ML algorithms to validate the proposed theoretical model.

2. Research model and hypotheses development

The main goal of the current work is to develop a conceptual model based on TAM. The research model is shown in Figure 1. The connections between the constructs in the model are described in the ensuing subsections.

2.1 Perceived playfulness (PP)

[30] Asserts that the original playfulness is explained as subjective enjoyment perceived while engaging in a certain behavior or activity. According to [4], [31], [32], PP has a positive impact on perceived usefulness and behavioral intention to use social networks. Consequently, the following hypotheses are put forth:

H1: Perceived playfulness (PP) would predict the perceived ease of use of social media networks (PEOU).

H2: Perceived playfulness (PP) would predict the perceived usefulness of social media networks (PU).

2.3 TAM constructs

The term "degree to which a person feels that employing a particular system will increase his/her work performance" (PU) [33] is used to describe this belief. PE stands for "the degree to which a person believes that adopting a given system will be independent of effort" [33]. It is thought that PU and PEOU make it easier for people to accept new technology. According to research [34], the behavioral intention to use social networks is a result of the significant positive impact of these two elements. PE was also thought to have a significant positive effect on PU. As a result, we propose the following:

H5: Perceived ease of use (PEOU) would predict the perceived usefulness of social media networks (PU).

H6: Perceived ease of use (PEOU) would predict the intention to use social media sites (SN).

H7: Perceived usefulness (PU) would predict the intention to use social media sites (SN).

These hypotheses form the foundation of the proposed research model, as shown in Figure 1. A structural equation model is initially used to represent the theoretical model, and it is then evaluated using machine learning methods.

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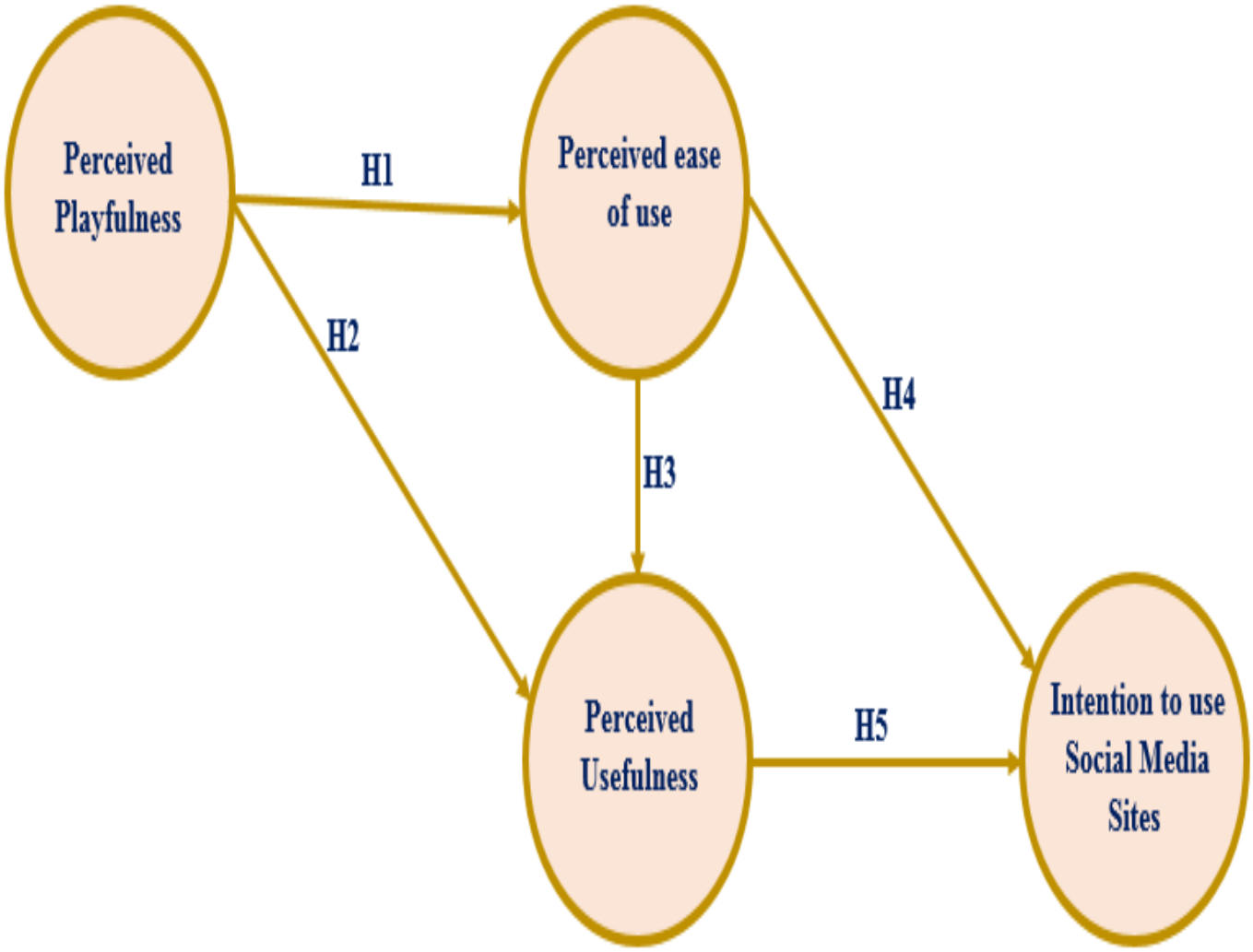

Figure 1:The proposed model

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3. Research Methodology

3.1. Context and subjects

Students enrolled in Emirates universities make up the study's participants. Self-administrated surveys were used to gather the data between October and November 2021, the collection was then used to make observations. The participants agreed to participate in surveys, and they received no payment for doing so. The data for this study were collected using a convenience sampling method. Out of the 700 questionnaires that were delivered, 623 students completed the whole survey, representing an 89 percent response rate. There were 344 men and 279 women among them. 78% of the participants were between the ages of 18 and 29. In addition, most participants (68%) had bachelor's degrees, followed by master's degree holders (27%) and Ph.D. candidates (5 percent).

4. Findings and Discussion

4.1 Data Analysis

In this study, two different techniques were used for evaluating the developed theoretical model [15], [16], [35]–[38]. Regarding the first technique, this research makes use of the SmartPLS tool with partial least squares-structural equation modeling (PLS-SEM) [19], [39]–[46]. The primary justification for using PLS-SEM in this work is that PLS-SEM offers contemporaneous analysis for both the measurement and structural model, which yields more precise results [47]–[53]. The second technique which is used in this work is for predicting the dependent variables in the conceptual model using machine learning algorithms using Weka [54].

4.2 Measurement model assessment

The validity and reliability of the measurement model are evaluated to test for accuracy [55]. The Cronbach's alpha and composite reliability (CR) measures were employed for reliability testing. Each of these measures should have a value of ≥ 0.70 [55]. The reliability is proven by the results in Table 1 since both measures' values are deemed satisfactory.

Hair Jr et al [55] Suggests assessing the convergent and discriminant validities of validity testing. The average variance extracted (AVE) and factor loadings were examined for convergent validity. While the values of factor loadings should be ≥ 0.70 [56], the values of AVE should be ≥ 0.50 [57]. The convergent validity is established based on the findings in Table 1 and the values for both measures are approved. [58] advised investigating the "Heterotrait-Monotrait ratio (HTMT)" of correlations for discriminant validity. The HTMT values should be < 0.85. All the values are accepted according to the readings in Table 2, as a result, the discriminant validity is achieved.

Table 1: Convergent validity results which assures acceptable values (Factor loading, Cronbach's Alpha, composite reliability ≥ 0.70 & AVE > 0.5).

Constructs	Items	Factor Loading	Cronbach's Alpha	CR	AVE
Intention to use social media sites	SN1	0.733	0.785	0.800	0.608
	SN2	0.854			
Perceived Ease of Use	PEOU1	0.791	0.842	0.812	0.761
	PEOU2	0.724			
	PEOU3	0.808			
Perceived Usefulness	PU1	0.846	0.868	0.835	0.769
	PU2	0.859			
	PU3	0.744			
Perceived Playfulness	PP1	0.834	0.819	0.812	0.717
	PP2	0.733			
	PP3	0.754			

Table 2: Heterotrait-Monotrait Ratio (HTMT).

	SN	PE	PU	PP
IU				
PE	0.373			
PU	0.391	0.344		
PP	0.336	0.397	0.637	

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4.3 Hypotheses testing and coefficient of determination

The combined testing of the mentioned five hypotheses was conducted using the structural equation modeling (SEM) method [59]. Each path's variance description (R^2 value) and path significance of each hypothesized connection in the research model were evaluated. Figure 2 and Table 4 show the standardized path coefficients and path significances.

According to Table 3, the R^2 values for PU, PEOU, and SN were in the range of 0.488 and 0.594. Thus, it seems that these constructs have Moderate predictive power [60]. In general, the facts supported every hypothesis. All the constructs from earlier investigations were confirmed in the model (PU, PEOU, and SN). The empirical data supported hypotheses H1, H2, H3, H4, and H5, according to the data analysis. The finding that Perceived Playfulness (PP) significantly influences Perceived Ease of Use (PEOU) (where $\beta= 0.662$, $P<0.05$) supports Hypothesis H1. Additionally, the findings indicated that perceived usefulness (PU) substantially affected perceived playfulness (PP) given that ($\beta= 0.716$, $P<0.05$) and perceived ease of use (PEOU) $\beta= 0.498$, $P<0.05$) validating the corresponding hypotheses H2 and H3.

Finally, H4 and H5 are supported since the intention to use social media sites (SN) significantly affects perceived ease of use (PEOU) $\beta= 0.512$, $P<0.001$) and perceived usefulness (PU) $\beta= 0.679$, $P<0.001$).

Table 3: R^2 of the endogenous latent variables.

Constructs	R^2	Results
SN	0.594	Moderate
PEOU	0.577	Moderate
PU	0.488	Moderate

Table 4: Summary of hypotheses tests at p**=<0.01, p* <0.05Significant at p**=<0.01 , p* <0.05.

H	Relationship	Path	*t*-value	*p*-value	Direction	Decision
H1	PP -> PEOU	0.662	2.993	0.028	Positive	Supported*
H2	PP -> PU	0.716	3.855	0.039	Positive	Supported*
H3	PEOU -> PU	0.498	9.826	0.005	Positive	Supported**
H4	PEOU -> SN	0.512	10.369	0.000	Positive	Supported**
H5	PU -> SN	0.679	13.823	0.000	Positive	Supported**

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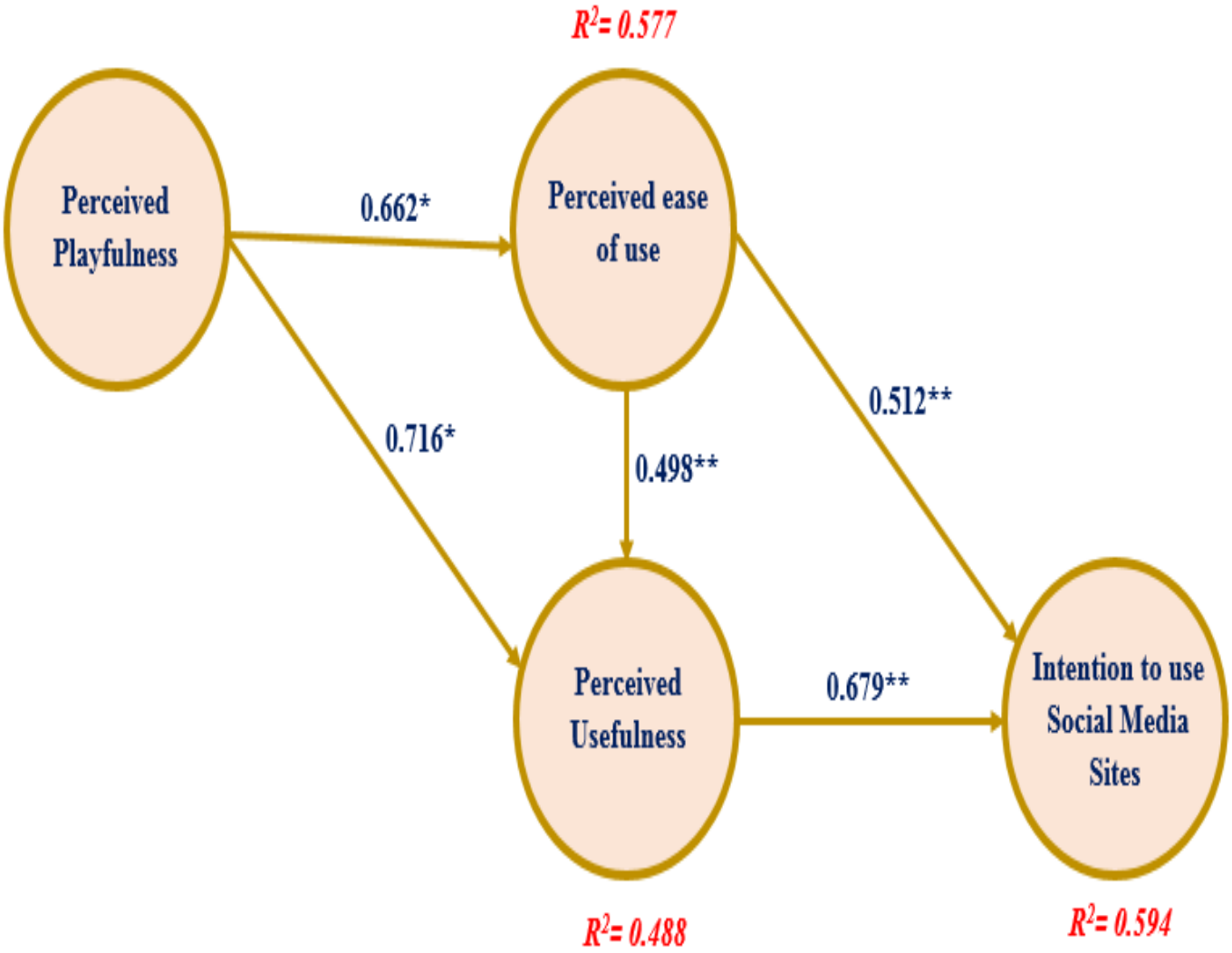

Figure 2: Hypotheses path coefficient findings

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4.4 Hypotheses testing using machine learning algorithms

To predict the correlations in the proposed theoretical model, this research uses machine-learning classification algorithms by employing a variety of approaches, such as Bayesian networks, decision trees, if-then-else rules, and neural networks [54]. The BayesNet, AdaBoostM1, LWL, Logistic, J48, and OneR classifier-based predictive models were tested using Weka (ver. 3.8.3) [61].

Based on the findings in Table 5, it is evident that J48 performs much better than the other classifiers in terms of PEOU prediction. For the 10-fold cross-validation, the J48 accurately predicted the PEOU with an accuracy of 85.39 percent. H1 is therefore supported. In comparison to the previous classifiers, the performance of this classifier is better in terms of TP rate (.854), accuracy (.859), and recall (.856).

Table 5: Predicting the PEOU by PP.

Classifier	CCI1 (%)	TP[2] Rate	FP[3] Rate	Precision	Recall	F-Measure
BayesNet	73.21	.732	.231	.739	.730	.733
Logistic	74.26	.743	.290	.746	.744	.744
LWL	76.19	.762	.224	.769	.769	.761
AdaBoostM1	80.27	.802	.320	.803	.811	.803
OneR	81.51	.815	.365	.820	.819	.812
J48	**85.39**	**.854**	**.666**	**.859**	**.856**	**.853**

[1]CCI: Correctly Classified Instances, [2]TP: True Positive, [3]FP: False Positive.

The results also showed higher classifier performance by J48 when predicting the PU when compared to other classifiers, as shown in Table 6. J48 correctly predicted the PU using the characteristics of PP with an accuracy of 80.93%. As a result, support existed for both H2 and H3.

Table 6: Predicting the PU by PP.

Classifier	CCI1 (%)	TP[2] Rate	FP[3] Rate	Precision	Recall	F-Measure
BayesNet	76.60	.766	.529	.769	.765	.762
Logistic	76.31	.763	.660	.764	.764	.760
LWL	77.24	.772	.662	.773	.777	.776
AdaBoostM1	78.48	.784	.669	.785	.786	.785
OneR	78.69	.787	.688	.788	.783	.784
J48	**80.93**	**.809**	**.794**	**.789**	**.800**	**.785**

According to the results shown in Table 7, J48 performed better than other classifiers in predicting the intention to use social media sites (SN) by considering of attributes of PEOU and PU. J48 predicted the intention to use social media sites (SN) with an accuracy of 81.15 percent. H4 and H5 were therefore supported.

Table 7: Predicting the SM by PEOU and PU.

Classifier	CCI1 (%)	TP[2] Rate	FP[3] Rate	Precision	Recall	F-Measure
BayesNet	79.20	.792	.789	.793	.791	.790
Logistic	79.45	.794	.798	.795	.793	.793
LWL	80.19	.802	.805	.803	.800	.803
AdaBoostM1	80.16	.802	.802	.803	.805	.804
OneR	80.29	.803	.810	.805	.802	.802
J48	**81.15**	**.811**	**.800**	**.812**	**.812**	**.813**

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5. Discussion

The proposed model was tested in this work utilizing a supplementary method that included PLS-SEM and machine learning classification algorithms. Because this work is one of the rare attempts to utilize machine learning algorithms in predicting the actual use of m-learning systems, the adoption of a complementary multi-analytical approach is thought to provide a novel addition to the literature on information systems (IS). It is worth noting that PLS-SEM may be used for predicting a dependent variable as well as validating a conceptual model depending on an extension of an existing theory [62]. Similarly, supervised machine learning algorithms (that is, those with a pre-defined dependent variable) may be used for predicting a dependent variable based on independent factors [54].

It is intriguing to see how many various classification algorithms, including decision trees, Bayesian networks, association rules, neural networks, and if-then-else rules, were used in the study each of them has different methodologies. More particular, the results showed that J48 (a decision tree) typically outperformed other classifiers. It is important to note that the sample was divided into homogeneous sub-samples based on the most important independent variable, and the decision tree (nonparametric) was used for classifying both continuous (numerical) and categorical variables [54]. On the other hand, PLS-SEM (a nonparametric approach) was applied to generate many sub-samples randomly and test the significant coefficients with replacements from the sample.

5. Conclusion and future works

The primary goal of this study was to investigate the variables influencing students' acceptance of social networks in the classroom. The TAM was adopted and extended by "perceived playfulness" to accomplish this goal. 320 valid questionnaire surveys in all were gathered from students enrolled at a reputed university in the UAE. Using the PLS-SEM and machine learning approaches, the suggested model was verified. The research findings showed that students' intentions to use social networks for learning have a significant positive impact on "perceived playfulness," "perceived usefulness," and "perceived ease of use." These results were in line with other research on social network acceptance [15], [16], [23]. These findings demonstrated how crucial it is for students to feel capable and secure using social networks in their academic work.

As a result, lawmakers, and managers of social media platforms in learning must concentrate on the factors that play an important role in promoting learning and boosting students' efficiency in developing and implementing successful social media applications. As a restriction, the information was gathered from a single private university in the UAE. Thus, the findings may not be generalized to other institutes of high education in the UAE. Further study on governmental students is required to discover the similarities and differences between government and private students in terms of the factors determined in the TAM model.

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