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The Acceptance of Social Media Sites: An Empirical Study Using PLS-SEM and ML Approaches

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Abstract. The study conducted aims to form a conceptual model to calculate the pupils' acceptance of social media in education and its factors. The study is carried out by extending the Technology Acceptance Model (TAM) using social influence factors. Alongside this, the collected data is evaluated through Machine learning approaches and the partial least squares-structural equation modeling (PLS-SEM). A total of 350 students enrolled at highly regarded universities in the United Arab Emirates (UAE) filled out questionnaire surveys, then analyzed, and results are stated. This research suggests that students' intention to adopt social media networks in learning is significant social influence, perceived usefulness, and ease of use.

Keywords: Social media · Technology acceptance model · Social influence · PLS-SEM · Machine learning

1 Introduction

A social network describes an online community where different people have the same interests met, share their photos and news about daily life [1]. With these online Communities, different peoples communicate with each other over the Internet with the help of emails and different messaging platforms [2]. Social media networking, like, Facebook was initially developed for students of intermediate level. Facebook enables individuals to create their accounts and share their photos and personal information [3]. Facebook is a form of communication where the information is sent through one medium and set out as a medium of sharing information [4]. It also enables people to interact with their friends even from a distance. Users can also join Facebook groups to interact with unfamiliar Facebook users. The group member can instantly and easily share and upload

files and links and other creative information and files free [5]. Social media has become frequent, mostly due to Internet services' availability, rearranging of these software, and the development of robust computers and mobiles [6]. Actually these media sources are spreading more widely and have become a powerful part of the lives of the peoples all around the world [7]. The majority of teachers and students use the Internet. Thus, social media have a significant role on the methods of teaching and learning [8, 9]. The Social media is still not very common everywhere [10]. There are some factors that could affect social media acceptance in schooling. These factors may be different in various countries. Hence, this case study fundamentally focuses on students' acceptance of social media in the United Arab Emirates UAE. The structural equation modeling (SEM) is used as a preferred methodology in technology acceptance research to examine and evaluate theoretical models. Therefore, this research has a two-fold objective; firstly, incorporating TAM [11] and social influence to evaluate and analyze the student's intention to use Social Media Sites; and secondly, utilization of ML and PLS-SEM algorithms to reinforce the theoretical model that has been developed.

2 Research Model and Hypotheses Development

This study initially focuses on a conceptual model that originated from TAM. Figure 1 shows the research model. The other subdivisions explain the association shared by different constructs in the model.

2.1 Social Influence (SI)

According to research, the intention of employment of social media networks is positively influenced by social influence. Social influence (SI), here, refers to "the degree of believe associated with the improvement in his or her job performance likely to be brought about by the use of a specific system by any person" [12]. This indicates:

H1: Social influence (SI) would predict the perceived usefulness of social media networks (PU).

H3: Social influence (SI) would predict the intention to use social media sites (SNS).

2.2 TAM Constructs

Perceived Usefulness (PU) measures "the degree of an individual's belief regarding the use of a particular system to have a positive impact on his job performance" [12]. Perceived ease of use (PEOU) has been described as "the degree of convenience perceived by an individual to be offered when using a particular system" [12]. It is perceived that the PU and PEOU ease the development of new technology. Research shows that there is a significant positive impact of these two factors on the behavioral intention to use social network [13]. It is also trusted that PU has a significant positive effect on PEOU, which is why we hypothesize these:

H2: Perceived usefulness (PU) would predict the perceived ease of use of social media networks (PEOU).

H4: Perceived usefulness (PU) would predict the intention to use social media sites (SNS).

H5: Perceived ease of use (PEOU) would predict the intention to use social media sites (SNS).

It is evident from Fig. 1 that the proposed research model emphasizes these hypotheses. The theoretical model was initially presented as a structural equation model followed by its evaluation using a machine learning method.
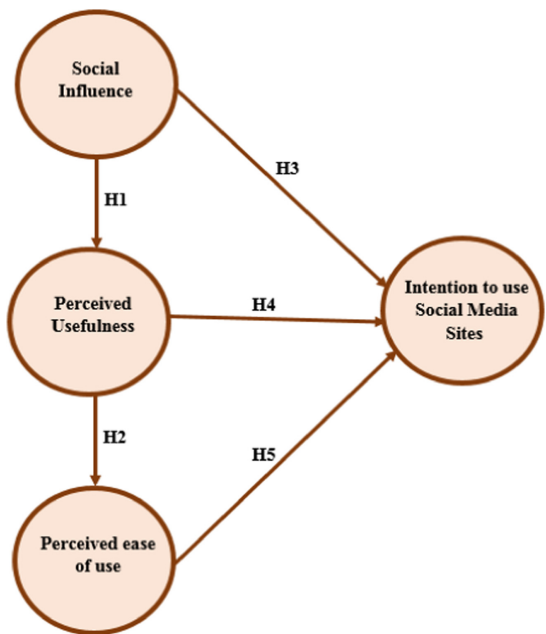

Fig. 1. The proposed model.

3 Research Methodology

3.1 Context and Subjects

In this study, students studying at two universities of the UAE were used as the participants. In 2020, self-administered surveys were used to collect the data between September and October. The participants took part in the study and agreed not to receive any reimbursement for their participation. The data of the study was collected using the method of convenience sampling. A total 0f 400 surveys were distributed out of which 350 students accounting for 88% completed the entire survey successfully. Out of the mentioned response rate, 210 were males, and 140 were females making 60% and 40% of participants. The age group of 18–29 years was the most dominant, making 69% of total participants; 55%, 30%, 10%, and 5% were bachelor, master, Ph.D., and diploma students.

3.2 Study Instrument

The study makes use of a research instrument which comprises of two parts designed solely for specific tasks. The first one is allocated to gather the participants' demographic data, while the second part is devoted to gathering responses concerning the conceptual model's factors. A "5-point Likert scale" is utilized to measure the objects in the second part. For the measurement of the PEOU and PU and for the measurement of Social Influence, items were adapted from [11, 14], respectively.

3.3 Pre-test of the Questionnaire

To measure the questionnaire items' reliability, a pilot study was conducted before moving towards the final survey. For this purpose, random selection was performed for the target population to select 50 students. The Cronbach's alpha was utilized to evaluate the internal reliability of the items of the construct. A benchmark of 0.70 or above is considered to be an acceptable reliability coefficient [15]. All the constructs used in this study fulfilled the acceptable criteria of the Cronbach's alpha and were found to be above 0.70, which can be seen in Table 1. This proves their reliability and hence makes them eligible for inclusion in the final study.

From the data given in the above table, it can be concluded that the questionnaire's 5 measurement scales are reliable and thus qualify for inclusion in the study.

Table 1. Cronbach's Alpha values for the pilot study (Cronbach's Alpha $\geq$ 0.70).

Construct	Cronbach's alpha
Intention to use social media sites	0.746
Perceived Ease of Use	0.799
Perceived Usefulness	0.787
Social Influence	0.836

4 Findings and Discussion

4.1 Data Analysis

To evaluate the developed theoretical model, the study makes use of two distinct techniques. The first technique employs the partial least squares-structural equation modeling (PLS-SEM) through the SmartPLS tool [16]. The fact that simultaneous analysis for both structural and measurement models can be achieved with PLS-SEM rendering results with greater precision, making it efficient to be used in this study. Whereas the second technique predicts the dependent variables of this study's conceptual model using the machine learning algorithms using Weka.

4.2   Measurement Model Assessment

Two factors, reliability, and validity, were tested to assess the measurement model. In order to carry out reliability testing, the measures of composite reliability (CR) and Cronbach's alpha were used. Both of these measures should have value ≥ 0.70 [17]. The findings in Table 2 demonstrate that both measures' values are deemed to be satisfactory and that reliability is hence verified.

According to [17], for validity testing assessment of two validities, convergent, and discriminant, was performed. In order to evaluate convergent validity, factor loadings and the average variance extracted (AVE) were tested with acceptable values to be ≥0.70 and ≥0.50 respectively [18]. The findings in Table 2 demonstrate that both measures fulfill the criteria to be accepted and thus, the convergent validity is established. According to suggestion of [19], the discriminant validity should be verified by "Heterotrait-Monotrait ratio (HTMT)" of correlations with acceptable value to be < 0.85. The findings in Table 3 show that all values are satisfactory and therefore, the discriminant validity is determined.

Table 2. 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	IU1	0.786	0.785	0.800	0.665
	IU2	0.810			
Perceived Ease of Use	PEOU1	0.856	0.771	0.765	0.687
	PEOU2	0.879			
	PEOU3	0.778			
Perceived Usefulness	PU1	0.845	0.863	0.826	0.798
	PU2	0.840			
	PU3	0.895			
Social Influence	SI1	0.836	0.787	0.730	0.630
	SI2	0.857			
	SI3	0.757			

4.3   Hypotheses Testing and Coefficient of Determination

Along with the Smart PLS with maximum likelihood estimation, the structural equation model was used to measure the interdependence of the structural model's various theoretical constructs [20–27]. Thus, the proposed hypotheses were evaluated. Table 4 shows that the R^2 values for the intention to use social media sites, perceived ease of use, and perceived usefulness ranged between 0.693 and 0.783. Therefore, these constructs appear to have high predictive power [28]. Generally, the data supported all hypotheses.

Table 3. Heterotrait-Monotrait Ratio (HTMT).

	IU	PEOU	PU	SI
IU				
PEOU	0.254			
PU	0.167	0.321		
SI	0.453	0.669	0.413	

Note: IU, Intention to use social media sites; PEOU, perceived ease of use; PU, perceived usefulness; SI, social influence

According to previous studies, all constructs were verified in the model (IU, PE, PU, and SI). Based on the data analysis, hypotheses H1, H2, H3, H4, and H5 were supported by the empirical data. Perceived Usefulness (PU) was determined to be significant in affecting Social Influence (SI) ($\beta = 0.577$, $P < 0.001$), and Perceived Ease of Use (PEOU) ($\beta = 0.361$, $P < 0.001$), supporting hypothesis H1 and H2 respectively. Finally, the results showed that intention to use social media sites (IU) significantly influenced Social Influence (SI) ($\beta = 0.308$, $P < 0.001$), Perceived Usefulness (PU) ($\beta = 0.642$, $P < 0.001$), and Perceived Ease of Use (PEOU) ($\beta = 0.538$, $P < 0.05$) supporting hypothesis H3, H4, and H5 respectively. A summary of the hypotheses testing results is shown in Table 5 and Fig. 2.

Table 4. R^2 of the endogenous latent variables.

Constructs	R^2	Results
IU	0.783	High
PEOU	0.693	High
PU	0.713	High

Note: Intention to use social media sites; PEOU, perceived ease of use; PU, perceived usefulness

4.4 Hypotheses Testing Using Machine Learning Algorithms

This study uses machine-learning classification algorithms to predict the correlation between constructs involved in the proposed theoretical models through the implementation of a comprehensive variety of methodologies such as if-then-else rule, Bayesian networks, and neural networks and decision trees [29]. The predictive model was tested by Weka (ver. 3.8.3) established by means of multiple classifier such as BayesNet, OneR, Logistic, AdaBoostM1, J48 and LWL [30].

Table 5. Summary of hypotheses tests at p** = < 0.01, p* < 0.05 Significant at p** = < 0.01, p* < 0.05.

H	Relationship	Path	t-value	p-value	Direction	Decision
H1	SI - > PU	0.577	19.619	0.000	Positive	Supported**
H2	PU - > PEOU	0.361	16.657	0.000	Positive	Supported**
H3	SI - > IU	0.308	18.760	0.000	Positive	Supported**
H4	PU - > IU	0.642	17.859	0.000	Positive	Supported**
H5	PEOU- > IU	0.538	6.806	0.040	Positive	Supported*

Note: IU, Intention to use social media sites; PEOU, perceived ease of use; PU, perceived usefulness; SI, social influence
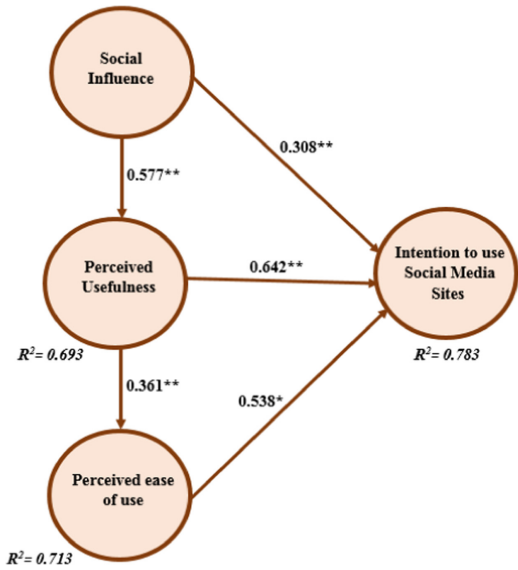

Fig. 2. Hypotheses path coefficient findings.

According to the results in Table 6, J48, as compared to other classifiers, performs better not only in evaluating the perceived usefulness of social media networks (PU) but also showed enhanced performance with regards to TP rate (.913), recall (.724), and precision (.801). For the 10-fold cross-validation, an accuracy of 90.33% predicted by J48 for the PU supported H1.

Similarly, the results in Table 7 indicate that in comparison with other classifiers, J48 showed enhanced classification performance in predicting the perceived ease of use of social media networks (PEOU). With an accuracy of 81.12%, J48 also played a significant role in supporting H2 as it predicted the PEOU through the perceived usefulness of social media networks (PU).

Table 6. Predicting the PU by SI.

Classifier	CCI1 (%)	TP[2] Rate	FP[3] Rate	Precision	Recall	F-Measure
BayesNet	84.47	.845	.253	.668	.662	.666
Logistic	84.47	.845	.320	.688	.675	.670
LWL	80.39	.804	.237	.712	.700	.686
AdaBoostM1	84.31	.843	.342	.732	.727	.722
OneR	85.23	.852	.387	.725	.723	.724
J48	90.33	.913	.688	.801	.724	.730

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

Table 7. Predicting the PEOU by PU.

Classifier	CCI1 (%)	TP[2] Rate	FP[3] Rate	Precision	Recall	F-Measure
BayesNet	77.22	.772	.437	.766	.772	.770
Logistic	77.42	.774	.380	.730	.774	.763
LWL	76.30	.763	.466	.765	.763	.763
AdaBoostM1	75.46	.755	.280	.754	.754	.752
OneR	76.75	.770	.470	.756	.767	.764
J48	81.12	.811	.382	.801	.822	.801

Based on the results in Table 8, H3, H4, and H5 are supported by means of J48 and OneR classifiers. In comparison with the rest of the classifiers, the J48 showed better performance in predicting the intention to use social media sites (IU) by the perceived ease of use (PEOU), perceived usefulness (PU), and social influence (SI) with an accuracy of 91.48%.

Table 8. Predicting the UI by SI, PU, and PEOU.

Classifier	CCI1 (%)	TP[2] Rate	FP[3] Rate	Precision	Recall	F-Measure
BayesNet	83.50	.835	.824	.833	.835	.835
Logistic	85.48	.855	.854	.847	.855	.854
LWL	85.70	.857	.848	.848	.857	.857
AdaBoostM1	84.28	.843	.844	.846	.843	.844
OneR	84.42	.844	.849	.844	.844	.845
J48	91.48	.915	.901	.902	.902	.902

5   Conclusion

The main focus of this study was to evaluate the factors affecting the student's acceptance of social network during their studies. To get this goal, the TAM was designed and extended by perceived playfulness. Total of 350 questionnaires surveys were gathered from the students registered in a reputed university in the UAE. The suggested model was authenticated by the PLS-SEM as well as machine learning approaches. The actual results proposed that "social influence", "perceived usefulness" and "perceived ease of use" exercise significant useful impact on student's intension to utilize social networks in studies. These research outcomes aligned with those of the earlier studies pertaining to social network acceptance [31–33]. These outcomes presented the usefulness of student's ability and trust in building social networks in academic ventures. Personnel associated with legislature and managers are enabled to focus on important aspects of social media that enhance student learning as well as to enhance students' efficiency to use social media applications. The main limitation of this study is that only a single private university from the UAE was approached for collecting data. Consequently, the generalization of outcomes to other educational organizations of the UAE became difficult. It is required to conduct additional research on governmental students in order to highlight the similarities and differences existing between students of government and private institutions in terms of the factors proposed in the TAM model.

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