

## Factors Affecting the Instructional Application of Virtual Social Networks in Higher Education

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### ABSTRACT

**Background:** Permanent access to virtual social networks enables individuals to use them as a platform for continuous learning. This study aimed to identify and analyze the factors affecting the use of social networks for virtual learning purposes.

**Methods:** This was an applied research using descriptive-analytic design and partial least squares structural equation modeling (PLS-SEM) for data analysis. The statistical population consisted of 110 students (including 98 freshmen) studying sociology at Payam Noor University, Tehran Center, Iran. The participants were active users of at least one of the social networks under study. A researcher-made questionnaire was developed using elements from similar research tools such as Mnkandla and Minnaar (2017). To analyze the content validity of the questionnaire, the research variables were reviewed and modified based on existing standard scales and consensus opinions of 5 academic experts (using Delphi technique). Stratified sampling was applied, and the questionnaires were administered to a sample of 90 students. Finally, 72 questionnaires were completed by the participants, and statistical analysis was conducted using Smart PLS software. The reliability of the instrument, as measured by Cronbach's alpha, was above 0.7 for all variables.

**Results:** The findings showed that perceived complementary features and perceived ease of use indirectly influence students' intention to use virtual social networks. Also, perceived usefulness ( $t=1.02$ ,  $P>0.05$ ) and attitude toward use ( $t=1.93$ ,  $P>0.05$ ) have no effect on their intention to use and 'trustworthiness' ( $t=4.13$ ,  $P<0.01$ ), and 'flow' has a direct effect on the intention to use the networks ( $t=2.05$ ,  $P<0.05$ ).

**Conclusion:** The results of this research would further support the academics' push for the use of social networks as a platform for virtual instruction and innovation in teaching-learning process.

**Keywords:** Social networking, Virtual education, Technology acceptance model, Higher education

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## Introduction

The development of information and communication technology (ICT) along with the evolution of social media has influenced many activities in the cyberspace, including methods of communication, thinking, working, and practice. In a word, it has transformed the social life of mankind, so that now all human achievements are being digitalized and adapted for remote access (1). The field of education is no exception and it should be acknowledged that emerging technologies, such as Web 1.0, Web 2.0 and online interaction tools have transformed the educational practices. Accordingly, ICT has now become a medium of learning and an important element of teaching-learning systems (2). At the same time, Internet-based communication has increasingly become the focus of attention by researchers (3). Social networks are now considered as one of the most popular means of communication, attracting billions of users around the world. Unlimited time and space, fluid and pluralistic nature, lack of structure, participatory features, multifaceted communication, accessibility and usability, timeliness and continuity are some of the unique features that have boosted the appeal of social networks. These features have also been regarded by many researchers as powerful stimuli for effective education (4). Given the diversity of the services provided by social networks, it is deemed highly important to make users continue using one social network over the others. Therefore, it is critical to understand why university students prefer a specific social network and how their choice affects their actual use of social networks. Online social networks provide a platform for interaction among users (5). In other words, online social networks are the Internet-based applications that users employ for receiving training, providing services, introducing products and brands, and the like (6). Since the advent of social networks, many researchers have studied their applicability for educational purposes (7). Some of the findings indicate that these networks can enhance group-based

critical thinking, project-based team learning, and group-based problem solving using the Internet tools (4).

The power of social networks does not solely lie in sharing of knowledge among members, but also in allowing for reflection and production of new knowledge. In these networks, ideas are generated, challenged, modified, critiqued, and assessed within a very large network, not in several years or months, but sometimes in a remarkably short span of a few minutes (8). Ratneswary and Rasiah (9) suggested that mobile social networks can be highly appealing to university students since they involve both learning and entertainment. In their work, Lee and Lehto (10) highlighted the factors that can affect people's behavioral intent to use new technologies in education. While Scott-Hayward et al. (11) emphasized the role of gender factors and the impact of technology on academic achievement, Lee and Lehto (10) focused on one's perception and attitude and its impact on the actual use of such tools; they considered compact structure and permanent accessibility as the main advantages of social networks in education. Much research has been conducted on users' attitude and intention in using social networks. Building on these research, the present study examines a framework consisting of various factors such as perceived ease of use, perceived usefulness, attitude toward using, intention to use, self-efficacy, trustworthiness, perceived complementarity, perceived enjoyment, and flow.

Davis et al. (12) introduced the Technology Acceptance Model (TAM), which is an adaptation of the theory of reasoned action, and predicts the user acceptance of information systems. TAM is a well-known model that determines user acceptance and use of technology, and is highly capable of explaining and predicting users' attitude towards information technology (13). In this study, TAM is considered as a suitable theoretical framework for analyzing the factors associated with acceptance of e-learning. External variables are proposed in this model as the basis for tracking the

effects of external factors on two main inner beliefs, namely perceived ease of use and perceived usefulness of technology. In addition, “behavioral intention to use technology” represents the effect of perceived ease of use and perceived usefulness on a dependent variable, that is, the actual use of technology. The “Technology Acceptance Model” is in fact an extended form of the “Theory of Reasoned Action” (14). Fishbein & Ajzen (15) explained the relationship between intention and behavior by identifying the connections between beliefs, attitudes, tendencies, and behaviors. According to the “Theory of Reasoned Action,” behavior is influenced by behavioral intention, which is guided by individual attitudes and subjective norms. Fishbein & Ajzen (16) maintained that attitudes are “people’s positive and negative feelings about conducting the given behavior” and that individual norms are thought of as “the person’s perception about what people who are important to them think they should or shouldn’t do”. On the other hand, the “Theory of Reasoned Action” suggests that intention, as the most important determinant of individual behavior, is influenced by the norms and attitudes of individuals towards their behavior and perception (P.216). The “Technology Acceptance Model” has been widely used to investigate the user acceptance of information technology in various fields. Among them, one can cite e-banking and mobile banking (17), multimedia (18), and health care technologies (19). According to Linjun (20), research on information-based systems indicates that cultural differences are the factor shaping different technology use patterns in different societies. At the same time, the determinants of different patterns for understanding and accepting technology in different cultures are still unclear. Therefore, it is necessary to conduct further research on the factors affecting technology acceptance and development in different cultures (21). According to the “Technology Acceptance Model”, perceived usefulness and ease of use jointly affect attitudes toward the use of technology while perceived usefulness

affects users’ behavioral intentions to use technology, which in turn is a factor affecting users’ actual use of technology.

Accordingly, considering the need to identify the factors affecting university students’ use of social networks as learning platforms, and in view of the research gap concerning the instructional applications of these networks, this study sought to examine and analyze the factors affecting educational use of virtual social networks from the perspective of undergraduate and graduate students at Payam-e-Noor University.

## Methods

This quantitative study was an applied research using a descriptive survey research design. Partial Least Squares Structural Equation Modeling (PLS-SEM) was applied for data analysis. PLS-SEM maximizes the variance of the dependent variables with the aim of causal modeling. This method focuses on variance, unlike other methods that use covariance (22). The study used the Smart PLS statistical software, which performs well with small samples. The statistical population of this study included all new undergraduate and graduate students of sociology who entered Payam-e-Noor University, West Tehran branch, in 2019. Using at least one social network was an important criterion for selecting the participants. Exclusion criteria included unwillingness to continue participation and failure to complete the questionnaires. According to the reports provided by the University, the target population consisted of 110 students. Questionnaires were distributed among 90 students using the relative stratified sampling method. This method was applied since the statistical population included students from both undergraduate and graduate programs. Eventually, 72 completed questionnaires (with a response rate of 80%) were returned and used for statistical analysis.

The data were collected using a 42-item researcher-made questionnaire, which was adapted from similar research tools such as Mnkandla and Minnaar (23), Heydari et al.

(24), and Hosseini et al. (25). Seven out of 42 questions were associated with demographic variables including gender, age, number of friends in groups, number of memberships in social networks, average time of using social networks per day. The remaining 35 questions were focused on measuring main variables of the research. The questions were scored based on a five-point Likert scale (very low =1 and very high =5). Therefore, the total scores of the respondents could range from 35 to 375. To ensure the content validity of the data collection tool, the research variables were reviewed and modified based on the existing standard scales and consensus opinions of 5 academic experts (using Delphi technique). Cronbach's alpha and composite reliability were calculated for each variable to determine the reliability of the research tool (Table 1).

While Nunnally and Bernstein (27) suggested the minimum appropriate reliability value to be 0.7, Table 1 shows that the value of these two indices (Cronbach's alpha coefficient and composite reliability) for all constructs is higher than 0.7.

Factor loadings for each of the latent variables were examined in order to ensure content validity of the data collection tool (Table 2).

Given that the proper value of a factor loading coefficient is at least 0.4 (Hulland, 1999) (26), the IU1 question (FL=0.115) was removed to prevent it from affecting other criteria and improve the measurement model. Moreover, in order to evaluate the validity of the measurement tool, Average Variance Extracted (AVE) and Discriminant Validity were examined, with the former being a

measure of the correlation between each construct and its associated questions. Although Zahoor et al. (28) considered a minimum of 0.5 to be sufficient for this index, the Average Variance Extracted (AVE) for all research variables were found to be over 0.5. Discriminant Validity compares the relationship between a construct and its indices on the one hand and its relationship with the other constructs on the other. Using Fornell-Larcker Criterion (29), it was observed that the AVE value for each construct of the model is more than the common variance between that construct and other ones in the model (i.e., the square of correlation coefficients between constructs).

### Structural Model

After determining the fitness of the measurement model, the fitness of the structural model of the research was examined. In doing so, two indices of  $R^2$  and  $Q^2$  were used (Table 3).

Since the above coefficients are related to latent endogenous (dependent) variables, some variables are not featured in Table 3. As for  $R^2$  index, which displays the effect of an exogenous variable on an endogenous one, the three values 0.19, 0.33, and 0.67 are introduced as weak, medium, and strong values (30). As can be seen, this index is found to be strong in all cases, except for perceived ease of use, which is rated as medium.  $Q^2$  determines the predictive power of the model. The values 0.02, 0.15, and 0.35 respectively represent the weak, medium, and strong predictive power of the constructs. In this study, the values of this index in all cases were found to be strong (30).

**Table 1:** Scale, Number of Questions, Cronbach's Alpha, and Composite Reliability of Constructs

Variable	Number of Questions	A	Composite Reliability (CR)	Source
Complementarity (CO)	4	0.75	0.84	17
Perceived Usefulness (PU)	5	0.84	0.89	14
Perceived Ease of Use (PE)	5	0.79	0.86	14
Perceived Enjoyment (EN)	4	0.85	0.90	17
Attitude to Use (AT)	4	0.85	0.90	14
Flow (FL)	3	0.83	0.89	15
Trustworthiness (TR)	3	0.70	0.83	16
Intention to Use (IU)	4	0.81	0.89	14
Actual Use (AU)	3	0.77	0.87	14

**Table 2:** Factor Loadings (FL) of Variables

Variable	FL	Variable	FL	Variable	FL	Variable	FL
CO1	0.710	PE1	0.668	FL1	0.792	TR3	0.691
CO2	0.732	PE2	0.702	FL2	0.885	IU1	0.115 *
CO3	0.768	PE3	0.775	FL3	0.910	IU2	0.905
CO4	0.811	PE4	0.731	AT1	0.787	IU3	0.838
PU1	0.789	PE5	0.808	AT2	0.852	IU4	0.811
PU2	0.817	EN1	0.864	AT3	0.857	AU1	0.794
PU3	0.750	EN2	0.806	AT4	0.835	AU2	0.882
PU4	0.814	EN3	0.762	TR1	0.799	AU3	0.805
PU5	0.752	EN4	0.891	TR2	0.853		

**Table 3:** Examining Structural Fitness of the Research Model

Variable	R <sup>2</sup>	Q <sup>2</sup>
Perceived Usefulness (PU)	0.846	0.471
Perceived Ease of Use (PE)	0.537	0.260
Perceived Enjoyment (EN)	0.688	0.435
Attitude toward Use (AT)	0.699	0.442
Intention to Use (IU)	0.777	0.519
Actual Use (AU)	0.969	0.627

### General Model

Only one criterion, namely Goodness of Fit (GoF) was used to evaluate the fitness of the general model of the research. For this purpose, the average variance extracted was multiplied by the average of the coefficients of determination ( $R^2$ ) and the square root of the result was calculated (31). The three values 0.01, 0.25, and 0.36 are respectively interpreted as weak, medium, and strong values for GoF, (32). The value of this index for the general model of the research was measured at 0.548, which shows a strong general fitness.

### Results

First, the demographic information of the participants in the study was examined. According to this analysis, the majority of participants were female (80.6%) and most of them (75%) were 25 years of age or younger. 41.7% of the participants announced that they were members of social media groups with 100 to 200 members, and 75% stated that they were members of more than 10 social channels. Meanwhile, 80.6% declared that they spend 1 to 3 hours a day using social networks and a remarkable 16.7% stated

that they spend 8 to 10 hours a day on these networks.

### Testing Hypotheses

The next step involved testing the conceptual model of the research using Structural Equation Modeling. The results of the analysis are presented in Table 4.

Based on the information obtained from data analysis, the final status of research hypotheses can be stated as follows:

**First hypothesis:** Perceived Complementarity affects Perceived Ease-of-Use. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.001$ ), indicating a significant association between these two variables, with an effect rate of 0.733.

**Second hypothesis:** Perceived Complementarity affects Perceived Usefulness. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.001$ ), indicating a significant association between these two variables, with an effect rate of 0.521.

**Third hypothesis:** Perceived Complementarity affects Perceived Enjoyment. As shown in Table 4, show that

**Table 4:** Analysis of Model Paths

No.	Paths	Estimate	t	P	Status
			Statistic	value	
1	Perceived Complementarity → Perceived Ease-of-Use	0.733	11.09	0.000	Accepted
2	Perceived Complementarity → Perceived Usefulness	0.521	7.70	0.000	Accepted
3	Perceived Complementarity → Perceived Enjoyment	0.830	24.53	0.000	Accepted
4	Perceived Ease-of-Use → Perceived Usefulness	0.467	6.69	0.000	Accepted
5	Perceived Ease-of-Use → Attitude toward Use	0.348	2.99	0.005	Accepted
6	Perceived Enjoyment → Attitude toward Use	0.406	3.04	0.003	Accepted
7	Perceived Usefulness → Attitude toward Use	0.151	1.31	0.150	Rejected
8	Perceived Usefulness → Intention to Use	0.102	1.02	0.330	Rejected
9	Attitude toward Use → Intention to Use	0.171	1.93	0.058	Rejected
10	Trustworthiness → Intention to Use	0.472	4.13	0.000	Accepted
11	Flow → Intention to Use	0.265	2.05	0.030	Accepted
12	Intention to Use → Actual Use	0.984	226.72	0.000	Accepted

the significance level is lower than the alpha level ( $P < 0.001$ ), indicating a significant association between these two variables, with an effect rate of 0.830.

**Fourth hypothesis:** Perceived Ease-of-Use affects Perceived Usefulness. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.001$ ), indicating a significant association between these two variables, with an effect rate of 0.467.

**Fifth hypothesis:** Perceived Ease-of-Use affects Attitude toward Use. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.01$ ), indicating a significant association between these two variables, with an effect rate of 0.348.

**Sixth hypothesis:** Perceived Enjoyment affects Attitude toward Use. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.01$ ), indicating a significant association between these two variables, with an effect rate of 0.406.

**Seventh hypothesis:** Perceived Usefulness does not affect Attitude toward Use. As shown in Table 4, the significance level is higher than the alpha level ( $P < 0.05$ ), indicating no significant association between these two variables.

**Eighth hypothesis:** Perceived Usefulness does not affect Intention to Use. As shown in Table 4, the significance level is higher than the alpha level ( $P < 0.05$ ), indicating no significant association between these two variables.

**Ninth hypothesis:** Attitude to Use does not affect Intention to Use. As shown in Table 4, the significance level is higher than the alpha level ( $P < 0.05$ ), indicating no significant association between these two variables.

**Ninth hypothesis:** Attitude to Use does not affect Intention to Use. As shown in Table 4, the significance level is higher than the alpha level ( $P < 0.05$ ), indicating no significant association between these two variables.

**Tenth hypothesis:** Trustworthiness affects Intention to Use. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.001$ ), indicating a significant association between these two variables, with an effect rate of 0.472.

**Eleventh hypothesis:** Flow affects Intention to Use. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.05$ ), indicating a significant association between these two variables, with an effect rate of 0.265.

**Twelfth hypothesis:** Intention to Use affects Actual Use. As shown in Table 4, the significance level is lower than the alpha level ( $P < 0.001$ ), indicating a significant association between these two variables, with an effect rate of 0.984.

Finally, the general model of the research is presented in Figure 1.

As mentioned earlier, the GoF index value for the general research model was 0.548, thus signifying a strong general fitness of the research model.

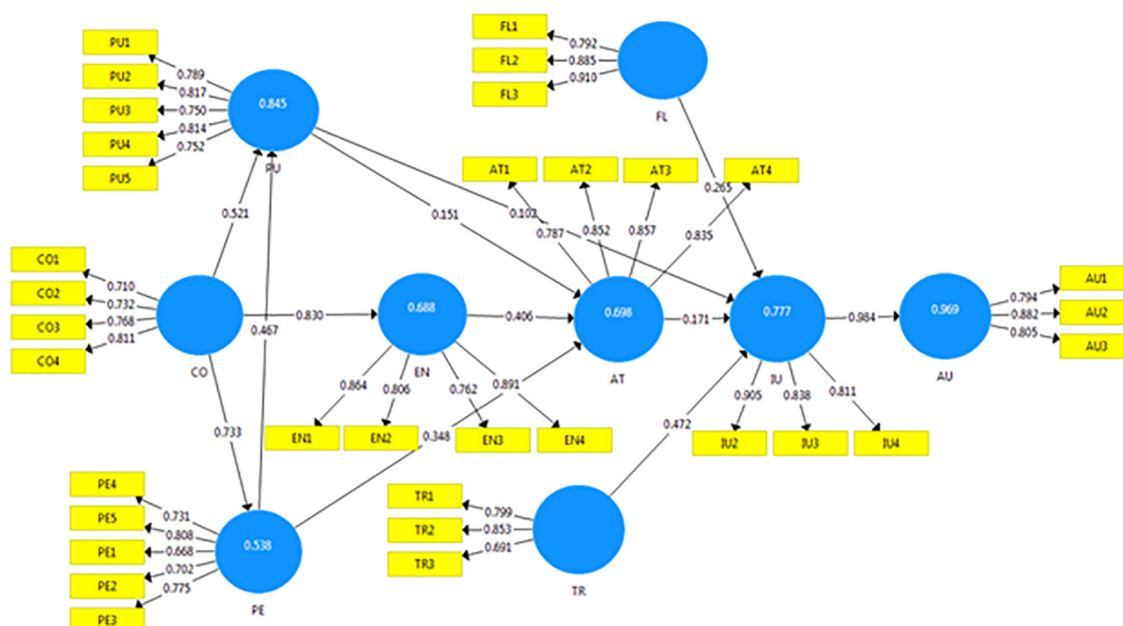


Figure 1: The Final Model of the Research

## Discussion

This study aimed at identifying and analyzing the factors affecting instructional application of virtual social networks in higher education. A review of the literature, particularly the models provided by experts, including Fernandez and Ilra's model of technology acceptance, suggested that eight factors affect the adoption of social networks for educational purposes, namely "Perceived Complementarity", "Perceived Usefulness", "Perceived Enjoyment", "Perceived Ease of Use", "Attitude toward Use", "Intention to Use Social Networks", "Flow", "Self-Efficacy" and "Trustworthiness". Accordingly, 12 research hypotheses were proposed. The Partial Least Squares Structural Equation Modeling (PLS-SEM) technique was used to analyze the data collected through the research instrument. The general model of the research was approved after examining the factor loadings caused by the direct and indirect effects of the factors and required modifications. Based on the data obtained from the fitted model regarding the effect of "Perceived Complementarity," "Perceived Ease of Use," "Perceived Usefulness," and "Perceived Enjoyment", the obtained result was consistent with that of Lin and Lu (33). On this basis, one can argue that

"Complementarity" refers to complementary services for further user interactions on social networks. It appears that features such as instant sharing of images, texts, and videos, and quick access to educational resources, professors, and other students can lead to usefulness and ease of use in exploiting virtual social networks and make them an enjoyable environment for students.

The findings showed that in using virtual social networks, "Perceived Ease of Use" affects "Perceived Usefulness" and "Attitude toward Use". Sun et al. (34), Chien et al (35), and Seif (36) have also emphasized this effect in their studies. Lim and Ting (37) suggested that Perceived Ease of Use refers to the amount of mental and physical effort put by a user into using technology. The results can be explained in the sense that a user-friendly virtual environment enhances the users' motivation to use that environment since its efficiency increases. The research findings showed that "Perceived Usefulness" does not affect students' "Attitudes toward Use" and "Intention to Use" virtual social networks. However, Heydari et al. (24) emphasized the effects of "Perceived Usefulness" on "Attitude" and "Intention to Use". Moreover, Teo et al (38) showed that students' use of web-based learning technologies is affected

by two factors: perceived ease of use and perceived benefits of that technology. Wilson et al. (39) also noted a significant relationship between employees' perceived benefits and their intention to use e-learning systems. Furthermore, Seif (36) concluded in his research that perceived usefulness affects the attitude and intention to use web learning.

Findings of the study suggested that "Attitude toward Use" does not affect students' "Intention to Use" virtual social networks. In line with this finding, Schaik & Teo (40) and Al-Adwan et al. (41) have rejected any significant association between attitude towards use and intention to use technology. Based on the literature, however, some studies such as Lee et al. (39) suggest that the attitude towards the use of e-learning predicts the intention to use an e-learning system. The findings revealed that perceived enjoyment affects the attitude toward using virtual social networks. Lin and Lu (33) have also emphasized the effect of perceived enjoyment on users' intention to use social networks. It appears that virtual social networks have the ability to provide a pleasant experience for users by creating value through the features they offer, and this experience leads to a positive attitude towards these networks. Miscellaneous features in virtual social networks encourage students to use these networks rather than other online learning platforms.

The findings showed that the two variables "Trustworthiness" and "Flow" affect students' "Intention to Use" virtual social networks. Studies by Rauniar et al. (42), Kwon et al. (43), and Sun et al. (34) emphasized the effect of these two variables on the intention to use online social networks. Briz-Ponce et al. (44) also identified 'trustworthiness' as an important factor in encouraging students to use cyberspace. However, some studies including the one by Heydari et al. (24) have negated this effect. It appears that in view of the ongoing development of virtual social networks, more people are inclined to use them. Daily use of these networks can also encourage users to place more trust in them.

Finally, the research findings showed that

"Intention to Use" affects students' "Actual Use" of virtual social networks. Tarhini et al. (45) also found a positive and significant association between people's behavioral intention and their actual use of e-learning. Moreover, Sanayei and Salimian (46) confirmed the effect of students' behavioral intentions on their actual use of virtual education. The intention or desire to use an object or phenomenon is an important indicator in determining people's behavioral intent. It can be argued that greater trust in virtual networks encourages users to further engage with these networks, which will practically result in increased use of these platforms in the future. The students' intention to use this phenomenon is expected to increase and, therefore, given the features and benefits of virtual social networks, their actual use of current social networks will also increase.

### **Authors' Contribution**

M. Mah and M. Mas developed the research methodology, performed the statistical analysis and wrote the conclusion. M. J. M. and M. Mo collected the required data, developed the statement of problem and literature review. All authors contributed to the final revision of the manuscript.

### **Ethical Approval**

At the beginning of the data collection stage, the participants were given a thorough explanation of the study and its objectives. With respect to ethical considerations, an attempt was made to preserve the confidentiality of the collected data and privacy of the participants. All procedures performed in studies involving humans were in accordance with the guidelines of Payam Noor University.

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### **Conflict of interests**

The author declares that they have no conflict of interests.



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