# VIRTUAL CLASSROOM ACCEPTANCE AND USAGE MODEL IN SECONDARY SCHOOLS

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## Abstract

The main goal of this study was to examine technological tool acceptance (such as the virtual classroom) among students of three secondary schools, using a model based on the Technology Acceptance Model (TAM). A survey instrument was used to test the hypotheses proposed in the research model. Data were collected using questionnaires answered by a sample of students enrolled on the Superior Grade Formative Course on Administration and Finance. Questionnaires were structured in two categories consisting of "assessment questions" and "classification questions". The assessment questions included six variables: intention, attitude, usefulness, enjoyment, concentration, and usage of virtual classroom. Classification questions included gender, age, and other demographics. The final sample consisted of 103 completed questionnaires, because students did not answer all questions; hence, some questionnaires were removed from the final analysis. The methodology used in this study was based on a partial least squares (PLS) estimation technique of structural equation modelling (SEM) oriented to the prediction (rather than confirmation) of cause/effect relationships. The PLS-SEM analysis corroborated the reliability of the proposed model. The findings suggested that students think the virtual classroom is easy to use, because it shares similarities with other technological tools. Moreover, students believed this platform motivated them to use it. This means that concentration and enjoyment were positively affected by usefulness (Hypotheses 1 and 2). Over time, these positive perceptions (concentration and enjoyment) develop attitude and intention; consequently, verifying the proposed model (Hypotheses 3, 4, and 5). The results indicated that intention, a previous step to behaviour, together with past experience, would enable us to predict the amount of time that students would use the virtual classroom during the Superior Grade Formative Course. This research has theoretical implications. First, the implementation of this technological tool should be a long-term and meticulous process, to improve several aspects of this platform. The mechanism should be attractive, easy to use, and visual to attract the student's attention and motivate them towards utilisation. Second, teachers of secondary schools should be trained to use such technological tools in general terms, and in particular on the central platforms they use, so that ultimately, they can transmit this knowledge to their students. The value of this study is to reveal student perceptions about use and acceptance of such tools in the virtual classroom. In this sense, this research has contributed to extending studies based on the TAM.

Keywords: technology acceptance model (TAM), structural equation modelling (SEM), virtual classroom.

## 1 INTRODUCTION

Globalisation and technological changes have developed in recent years, encouraging information and communication technologies (ICT) in the personal and professional lives of users. [1] defines ICT as a set of processes and products arising from the use of new tools (hardware and software), the reinforcement of purposes and communication channels related to transmission, and the storage and processing of digitalised information. In the Spanish context, the use of ICT has been extended in primary and secondary schools ([2], [3]) and in superior education ([4]), and is considered part of the teaching–learning process. Implementation and integration of ICT in educational centres involves a significant change, which depends on the teachers' abilities and the incorporation of ICT in schools ([5]). In this sense, autonomous governments have invested in ICT resource provisioning and the training of teachers to transmit more education using technological models ([6]).

The use of ICT in the classroom improves the attention of students, helps the educational work of the lecturers and allows them to organise their ideas, as suggested by [7]. Past research has explored the effect of the use of ICT in educational centres and its effect on improvements in learning and educational quality ([8], [9]), the autonomy of students, and the transmission of knowledge from

professor to student ([10]), improvement in academic performance ([11], [12]), the motivation of students ([12]), the effect of changes in methodologies, and the reorganisation of space and time ([3]) The aim of this study is to analyse technological tool acceptance (such as the virtual classroom) among students of three secondary schools during an academic course for the year 2017/2018, using a model based on the technology acceptance model (TAM). The model proposed in this study is based on the TAM original model, although it was adapted particularly by removing the variable for ease of use because nowadays all students are consumers of technology and they tend to be familiar with advances in technology ([13]). The findings will explain and improve the experience of students in the use of virtual classrooms. Simultaneously, it will motivate professors to improve and increase the use of this technological tool inside and outside the classroom. The results obtained in this paper provide evidence that there is a positive and direct relation between aptitude and intention towards use of the virtual classroom, as evidenced by [14], [15], [16], [17], [18], and [19]. Moreover, the findings also show that there is a positive and direct relationship between perceived usefulness and attitude towards use of the virtual classroom, echoing the findings of [14] and [16]. The findings of this research make several contributions to the existing literature. First, this study contributes to past research based on the acceptance of virtual classrooms by students in upper secondary education through the model based on the TAM. Second, these findings support the premise that the use of technological tools in the classroom is essential for education. Third, this study helps to predict virtual classroom use in secondary schools. The paper is presented as follows. Section 2 provides the theoretical framework and hypotheses. Section 3 outlines the sample and methodology. Section 4 offers the results. Section 5 presents the conclusions.

## 2 THEORETICAL FRAMEWORK AND HYPOTHESES

The TAM was developed by [20] to analyse factors that could influence technology acceptance of users. This model is based on the premise that the acceptance of any type of technology by users depends on their belief about possible consequences of utilisation. According to [21] and [22], TAM was considered the theory with biggest impact on the educational approach. This model is supported by psychological theory such as the theory of reasoned action (TRA) proposed by [23], who postulated that the process of technology acceptance depends on two motivational extrinsic constructs, namely perceived usefulness and ease of use (Fig. 1). For this reason, TAM models are based on analysis of technological information, whereas the TRA models focus on the establishment of factors that determine the intention, attitude, and intensity of final use. In this sense, [20] defined perceived usefulness (PU) as the probability that one individual could improve their job actuation when they use a technological tool (such as the virtual classroom). In the same way, he defined perceived ease of use (PEOU) as the ability of an individual to use technology (such as the virtual classroom) without great effort. However, previous research has questioned the relationship between PU and PEOU. The existence of a relationship between intention and attitude of users has been affirmed [24].

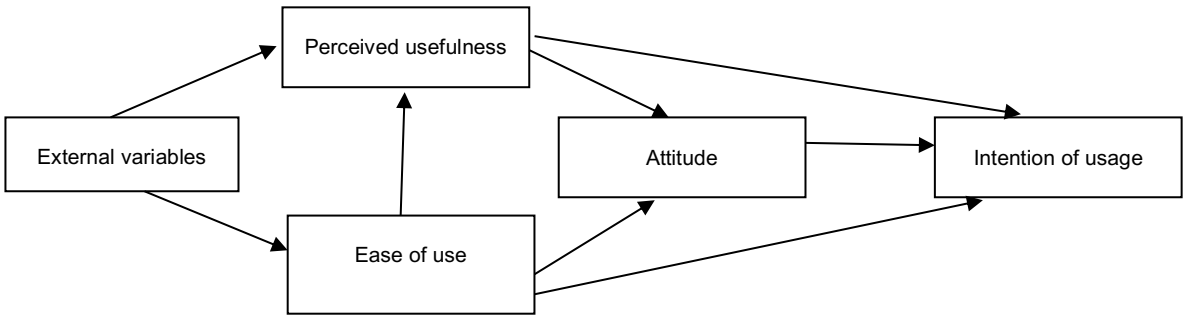


***Figure 1.*** *TAM [20].* ***Source:*** *Prepared by the authors on the basis of the [20]*

Accordingly, the original TAM model has introduced some changes from others theories in terms of variables used, which have led to the development of the TAM2 and TAM3 ([25]). These included advances from previous research but still support the approach by [20]. Previous research (that focused on the use of technological tools such as a virtual classroom) was supported by the premise that users were satisfied with the use of online navigation and by their intentions toward utilisation. Thus, perceived enjoyment from using a virtual classroom is defined as the experience of the use of technology, including aesthetic value as well as instrumental value. In this sense, [26], [27] and [28] stated that enjoyment of technology use is related to perceived usefulness. Authors such as [29] have

documented that these tools can provide value for users that cannot defined as either perceived usefulness or ease of use, which enables them to obtain a satisfactory state through optimal experience. Accordingly, [30] documented that utility was considered an essential factor regarding intention for use of virtual classrooms. Enjoyment will allow clarify the variance explained by the nature utility factors. Conversely, [31] and [32] discussed cognitive absorption—a state in which the individual finds perceived usefulness and ease of use through involvement in use of the technological tool. Thus, [33] confirmed that the level of concentration was positively correlated with intention to use the technological tool as a virtual classroom. Therefore, based on above arguments, we propose the following hypotheses:

***Hypothesis 1:*** *A high level of concentration of users will be positively correlated with higher levels of perceived usefulness of the virtual classroom.*

***Hypothesis 2:*** *A high level of enjoyment of users will be positively correlated with higher levels of perceived usefulness of the virtual classroom.*

The TAM model proposes that PU is considered the extrinsic motivation that affects the use of virtual classrooms directly through intention and indirectly through attitudes. However, in line with the work of [20], some models support direct links between usefulness and intention, although direct influence which has a belief as the usefulness on the use intention is against some premises of the TRA mode. [34] and [15] provide evidence of a positive and significant relationship between usefulness and intention. Moreover, [14] showed in their paper that there was a direct relationship between perceived usefulness and attitude towards the use of websites, which increased incentive and unadjusted attitude, in line with [35]. Furthermore, [36] and [16] indicated a positive relationship between perceived usefulness and attitude toward use of the virtual classroom. Hence, considering the above arguments, we propose the following hypotheses:

***Hypothesis 3:*** *Perceived usefulness will be positively correlated with attitude toward the usage of virtual classrooms.*

***Hypothesis 4:*** *Perceived usefulness will be positively correlated with intention to use virtual classrooms.*

The models based on TRA ([23]) and TAM ([20]) postulated a positive and significant relationship between attitude toward use, intention to use, and actual use of information systems. The TRA-focused perspective proposed that beliefs (usefulness) established the attitudes toward use of virtual classrooms or any other technological tool. At the same time, intention related to utility of virtual classrooms is influenced by attitude toward use, and ultimately, the intention to use virtual classrooms. According to past arguments, we propose that there is a positive and direct relationship between attitude and intention toward the use of virtual classrooms ([14], [15], [16], [18], [19]) as well as between the intention to use and actual usage ([14], [15], [36], [17]). Thus, according to the above arguments, we posit the following hypotheses:

***Hypothesis 5:*** *Attitude toward the use of virtual classrooms will be positively correlated with the intention to use virtual classrooms.*

***Hypothesis 6:*** *Intention to use will be positively correlated with the intention to use virtual classrooms.*

# 3 METHODOLOGY

## 3.1 Development of instruments

A survey instrument was used to test the hypotheses proposed in the research model. To guarantee the student body's compression, the questionnaire was divided into different sections to represent each hypothesis. The questionnaire was structured as follows:

1 a presentation of the investigation;

2 details about who should answer the questions; and

3 assurance of confidentiality and anonymity for respondents.

The questionnaire was structured into two categories: "assessment questions" and "classification questions". The assessment questions included six variables: intention, attitude, usefulness, enjoyment, concentration, and use of virtual classrooms. The classification questions include demographic details such as gender and age. These variables were measured using a 5-point Likert

scale ranging from 1 “strongly disagree” to 5 “strongly agree”. The analysis used in this study was based on a partial least squares (PLS) estimation technique of structural equation modelling (SEM) oriented to the prediction (rather than the confirmation) of cause/effect relationships.

## 3.2 Sample

The sample included students from three secondary schools who were enrolled on the Superior Grade Formative Course on Administration and Finance for the academic year 2017/2018. Students completed the questionnaire during theoretical classes (after it had been previously reviewed by two experts). A total of 150 questionnaires were distributed, and 103 were eventually included in the analysis (some being removed for being incomplete). Table 1 presents the study specifications.

***Table 1.*** *Study specifications*

| ***Population*** | |
|---|---|
| Location | Three secondary schools in Valencian Community |
| Date | February 2018 |
| ***Sampling*** | |
| Type | Random |
| Survey Method | A questionnaire completes in theoretical classes |
| Sample size | 103 valid questionnaires |
| Sample error | +5,42% |
| Level of confidence | 95%Z=2P=Q= 0.5 |

# 4 RESULTS

Statistical analysis of the results of the model was conducted under the approach of variances (PLS-SEM). A two-stage approach allowed a validation global model to be applied as an integral method ([37]) using the SmartPLS program ([38]). The measurement model was evaluated first, followed by the SEM.

## 4.1 Subsection Measurement Model

The purpose of estimation in the measurement model was to check whether the latent variables were measured correctly through the observed variables. We analysed individual and composite reliability, and convergent and discriminant validity of the latent variables using the following four criteria:

Criterion one: individual reliability was considered sufficient when loads of an item or observed variable was greater than 0.707 ([39]). The significance of the load was determined using the bootstrap resampling procedure (in our case 2000 subsamples of the original sample size). We report in Table 2 that all variable loads were greater than 0.707.

***Table 2.*** *Individual Reliability of measurement model*

| ***Indicator*** | ***Composite*** | ***Individual reliability*** | ***Item description*** |
|---|---|---|---|
| P1_1 <- Intention | Intention | 0,957 | Given that I have Access to the virtual classroom, I intent to use it |
| P1_2 <- Intention | | 0,961 | Given that I have Access to the virtual classroom, I predict that I would use it |
| P2_1 <- Attitude | Attitude | 1,000 | I have a positive attitude towards using the web |
| P2_2 <- Usefulness | Usefulness | 0,859 | Browsing with virtual classroom improves my performance |
| P2_3 <- Usefulness | | 0,841 | Browsing with virtual classroom improves my productivity |
| P2_4 <- Usefulness | | 0,843 | Browsing with virtual classroom improves my effectiveness |
| P2_5 <- Usefulness | | 0,722 | Browsing with virtual classroom is interesting |
| P2_6 <- Usefulness | | 0,685 | Browsing with virtual classroom is useful |

| | | | |
|---|---|---|---|
| P3_1 <- Enjoyment | Enjoyment | 0,828 | Browsing with virtual classroom is pleasant |
| P3_2 <- Enjoyment | | 0,808 | Browsing with virtual classroom is fun |
| P3_3 <- Enjoyment | | 0,831 | Browsing with virtual classroom is entertaining |
| P3_4 <- Enjoyment | | 0,770 | Browsing with virtual classroom is enjoyable |
| P4_1 <- Concentration | Concentration | 0,786 | When I browse the virtual classroom, I am absorbed intensely in browsing |
| P4_2 <- Concentration | | 0,922 | When I browse the virtual classroom, I concentrate fully on browsing |
| P4_3 <- Concentration | | 0,922 | When I browse the virtual classroom, my attention is focused on browsing |
| In_p6 <- Usage | Usage | 1,000 | On average, how much time would you estimate that you personally spend on virtual classroom session? |

Criterion two: this refers to the internal consistency of the latent variables (Table 3), analysed through composite reliability. This indicator represents the variance shared between a set of observed variables that measure a construct ([40]). In general, a composite reliability of at least 0.6 is considered valid ([41]). This criterion is increasingly demanding in the sense that approximately 0.70 is required in the early stages of research, and values of between 0.80 and 0.90 for more advanced stages. A value below 0.60 indicates a lack of reliability. ([42], p. 299). Table 3 shows that the required values are greater than this threshold in this study.

Criterion three: This is the average extracted variance (AVE), which evaluates the amount of variance that a latent variable capture from its observable variables compared to measurement error ([40]). This convergent validity is obtained through communality, and the average of the communality of each latent variable provides the AVE indicator. These criteria hold that latent variables with an AVE of at least 0.5 have the capacity to explain at least half of the variance of their observable variables, on average. The AVE indicators are presented in Table 3.

***Table 3.*** *Internal consistency and Convergent validity of measurement model*

| *Composite* | *Composite reliability* | *AVE* |
|---|---|---|
| Attitude | 1 | 1 |
| Concentration | 0,91 | 0,77 |
| Enjoyment | 0,88 | 0,66 |
| Intention | 0,96 | 0,92 |
| Usage | 1 | 1 |
| Usefulness | 0,89 | 0,63 |

Criterion four: This is discriminant validity, so we reported values of the HTMT indicator from SmartPLS in Table 4. According to [42], values of HTMT indicator must be less than 0.9 if we consider conservatively method.

***Table 4.*** *Discriminant validity (HTMT) of measurement model*

| | *Attitude* | *Concentration* | *Enjoyment* | *Intention* | *Usage* | *Usefulness* |
|---|---|---|---|---|---|---|
| Attitude | | | | | | |
| Concentration | 0,46 | | | | | |
| Enjoyment | 0,47 | 0,58 | | | | |
| Intention | 0,53 | 0,51 | 0,51 | | | |
| Usage | 0,17 | 0,23 | 0,17 | 0,28 | | |
| Usefulness | 0,49 | 0,48 | 0,55 | 0,60 | 0,10 | |

Overall, we confirm that the analysis of these four criteria of the measurement model are adequate through individual reliability, internal consistency, convergent validity and discriminant validity.

Therefore, we applied scales from observed variables based on the previous literature in order to estimate latent variables. Consequently, we can conclude that the measurement model is correct.

## 4.2 Structural Model

In the structural model, we specified hypotheses by a set of latent variables and relationships that we wanted to analyse. We began by checking the fit of this model (which is predicting-orientated); then, we could continue by estimating direct effects (hypotheses). This refers to which variables would be significative in our proposed model and their relative intensity. Moreover, we studied whether there would be differences in intensity when we created two groups.

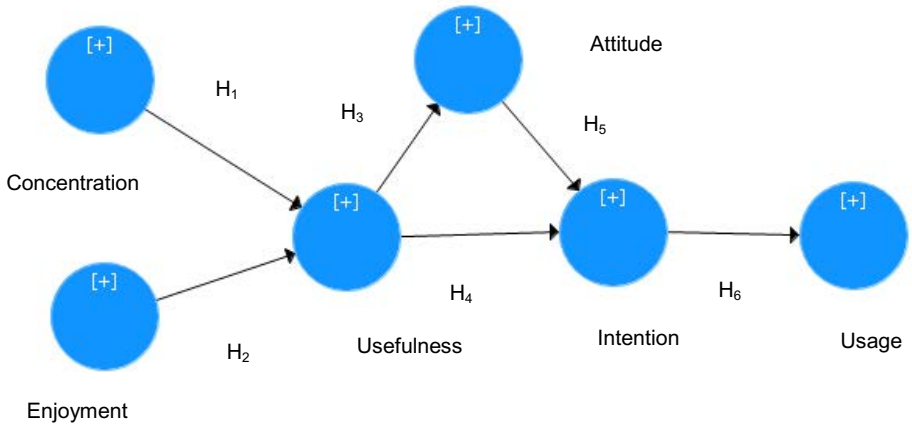


***Figure 2.*** *Structural model by SmartPLS 3*

It is recognized in the literature that the evaluation of fit in the structural model is carried out by an SRMR indicator (SRMR Composite Factor Model). This indicator was provided by SmartPLS 3, and should be less than 0.08 ([42]), being the value of our estimated model of 0.075.

Thus, we could already analyse the results of the tests for the hypotheses with SmartPLS, seeing the direct effects. Interpretation of the coefficients (or beta) was the same as the interpretation for the standardised regression coefficients. It was evident that the values were not close to zero; therefore, it could be suggested that our model demonstrates a relationship between these paths of the hypotheses. Researchers in PLS report confidence intervals instead of t-values in order to contrast coefficients. Confidence intervals are a non-parametric approach, and are not based on any type of distribution. According to [42] “If a confidence interval for an estimated path coefficient w does not include the zero value, then the hypothesis that w is equal to zero is rejected”. As is evident from the Table 5, we cannot reject any of the hypotheses of our structural model with PLS.

***Table 5.*** *Direct effects and Hypothesis*

| *Hypothesis* | *Path* | *Beta* | *2.5%* | *97.5%* |
|---|---|---|---|---|
| H5 | Attitude -> Intention | 0,33 | 0,13 | 0,50 |
| H1 | Concentration -> Usefulness | 0,24 | 0,02 | 0,44 |
| H2 | Enjoyment -> Usefulness | 0,37 | 0,18 | 0,57 |
| H6 | Intention -> Usage | 0,26 | 0,10 | 0,44 |
| H3 | Usefulness -> Attitude | 0,46 | 0,32 | 0,60 |
| H4 | Usefulness -> Intention | 0,38 | 0,22 | 0,58 |

We divided the sample into two different groups. One was the institute under study (Vall de Uixó), and the other was composed of two others institutes (Sant Mateu and Castellón de la Plana). This enabled us to analyse the relationships from a "multigroup" perspective. We studied the variation in the intensity of the relationships between latent variables as a consequence of several groups and the possible validation of the formulated hypotheses. Considering the effects of the group did not limit the relevance of the research. Differences between groups were analyzed to establish whether the behavior of the variables from the general model was the same that if we divided between two groups.

Multigroup analysis (MGA) is a method used to test multiple groups of data. The most common method is PLS-MGA (Table 6), which is a non-parametric test of the difference between specific results of the groups and is based on bootstrapping PLS. The criterion for a difference between the path coefficients of the specific group is significant at a 5% probability of error level (if the value of p is less than 0.05 or greater than 0.95). The PLS-MGA method ([43]) uses SmartPLS run as an extension of Henseler's original non-parametric MGA method and described in [44]. We obtained two intensity differences in path coefficients: the first between attitude and intention, and the second between usability and attitude. In our conclusions, we expand the discussion of the results that were obtained in this study.

***Table 6.*** *Multigroup test*

| *Path* | *Difference* | *p-value* |
|---|---|---|
| Attitude -> Intention | 0,435 | **0,973** |
| Concentration -> Usefulness | 0,080 | 0,317 |
| Enjoyment -> Usefulness | 0,241 | 0,073 |
| Intention -> Usage | 0,136 | 0,213 |
| Usefulness -> Attitude | 0,339 | **0,955** |
| Usefulness -> Intention | 0,086 | 0,375 |

## 5 CONCLUSIONS

The focus of this paper was to examine technological tool acceptance for virtual classrooms among students from three secondary schools, using a model based on TAM.

The results show that concentration has a positive and direct relationship with virtual classroom usefulness, in line with [31] and [32]. Thus, we cannot reject the first hypothesis proposed. Moreover, the findings also suggest that there is a positive and direct relationship between enjoyment and usefulness, in accordance with [26], [27], and [28]. For this reason, we cannot reject the second hypothesis. Furthermore, the results also suggest a positive and direct association between perceived usefulness and attitude towards use of virtual classrooms ([14], [16]). Conversely, the findings perceived usefulness as positively correlated with intention toward use of virtual classrooms ([34], [15]). The findings also illustrated a positive relationship between attitude of the students and use of virtual classrooms, as evidenced by [14], [15], [16], [17] and [18]. Finally, the results show that intention of use is positively related with actual usage of virtual classrooms ([14], [15], [36], [17]). Therefore, we can conclude that all hypotheses proposed in the general model were fulfilled. The findings provided evidence that students consider virtual classrooms to be easy to use because similarities with other technological tools. Moreover, students indicated that this platform motivates them to use it. This mean that concentration and enjoyment positively influence usefulness (Hypotheses 1 and 2). Over time, these positive perceptions by students (concentration and enjoyment) develop into attitude and intention; consequently, the proposed model is verified (Hypotheses 3, 4, and 5). The results show that intention (a previous step toward behaviour) regarding decisions on repeated in long-term supported with past experience, allow us to predict the time that students will use the virtual classroom in the Superior Grade Formative Course. The value of this study is that it reveals the perceptions of students about both use and acceptance of grade virtual classrooms. In this sense, this research has contributed to extending studies based on the TAM.

This research also has theoretical implications. First, the implementation of this technological tool should be a long-term and meticulous process, to improve several aspects of this platform. This mechanism should be attractive, easy to use, and visual in order to attract the student’s attention and motivate them towards utilization. Second, secondary school teachers should be trained in technological tools in general terms and in particular on the central platforms used by such tools, so that ultimately, they can transmit their knowledge to the students.

The main limitations of this study are summarised as follows. First, the data analysed in this study was gathered from questionnaires answered by the students of Superior Grade Formative Course on Administration and Finance from three secondary schools in the Valencian Community during the academic year 2017/2018. Subsequently, the results should not be extrapolated or generalised to other formative and academic courses. Second, this study did not take account of the opinion of the teachers in terms of usage and training for virtual classrooms. Third, it is possible that there are

unknown factors which impact on the variables studied. Even though we controlled all the factors used in previous research, the theoretical and empirical limitations have limited the ability to know whether we analysed all relevant factors. Finally, our study could be useful for future researchers interested in comparing assessment of students of other formative courses and the Formative Course on Administration and Finance with regard to the use of technological tools such as a virtual classroom. Further research could consider including the views of teachers and professors about the use of virtual classrooms as a technological tool in the classroom.

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