An investigation of university students’ attitude, satisfaction and academic achievement in online learning: empirical evidence from a developing nation

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Abstract

Purpose – Following the COVID-19 pandemic, most higher education institutes shifted to online learning as the sole alternative to continuing education while mitigating the risks imposed by the pandemic. This has raised several concerns regarding students’ learning experience, satisfaction and academic achievement, particularly in countries where students have restrained technological resources (i.e. developing nations). The current research aims to investigate the key factors influencing students’ attitudes, satisfaction and academic achievement among university students in an emerging market context (i.e. Morocco). The moderating effect of students’ motivation to study online was also scrutinized.

Design/methodology/approach – The authors propose an integrated conceptual framework that combines the technology acceptance model (TAM) with the outcomes of prior literature related to online learning. Based on data collected from 850 Moroccan university students, the authors empirically tested the conceptual model using a partial least squares (PLS) estimation.

Findings – First, attitude toward online learning and satisfaction positively impact university students’ academic achievement; at the same time, attitude positively impacts students’ satisfaction with online learning. Second, students’ satisfaction and attitude toward online learning were found to be mainly influenced by instructor performance, ease of use of the online learning platform, information quality, interactivity and perceived usefulness (PU). Finally, student motivation acts as a moderator, e.g. students with higher motivation to learn online are more likely to develop a favorable attitude toward online learning and can, therefore, accomplish better academic performance.

Originality/value – The current study makes a considerable contribution to the literature by contributing to the on-going debate about the potentials and challenges of online learning, particularly in an emerging country where education remains a considerable challenge. The study findings can help higher education institutes gauge the quality of online education programs and design efficient strategies to develop high-quality online
learning for students. Our findings have implications not only for educational institutions and instructors in developing markets but also for the vendors of online course delivery software.

**Keywords** Online learning, Attitude, Satisfaction, Student motivation, Academic achievement, Structural equation modeling, Emerging nation

**Paper type** Research paper

1. Introduction

While online learning had its beginnings in the 1990s, it only reached its pick following the COVID-19 pandemic. The crisis has sped up the transition to remote learning techniques and online learning has steadily grown to become the main learning mode during the lockdown (Lei and So, 2021). Though it presented a number of advantages (i.e. greater flexibility and accessibility), online learning raised numerous concerns with regards to instructors and students’ satisfaction with the online learning experience (Gopal et al., 2021). A number of studies have investigated the factors influencing attitudes and satisfaction with online learning, including technological elements like ease of use and dependability, social aspects like interaction with peers and instructors and particular characteristics like motivation and prior online learning experience (Eom and Ashill, 2016; Maqableh et al., 2021). Still, the effect of the above-mentioned variables on students’ academic success was not much investigated in the post-pandemic era. The current research attempts to scrutinize the key factors influencing students’ attitude, satisfaction and academic achievement among university students in an emerging market context (i.e. Morocco). The moderating effect of students’ motivation to study online was also taken into account.

According to the World Bank Human Capital Index (HCI), Morocco is one of the countries that successfully implemented the necessary precautions to protect and invest in students (World Bank Open Data, 2022). Following the global lockdown imposed by the COVID-19 pandemic, Moroccan schools and universities were urged to find alternative teaching delivery modes to support the government’s protective measures. Online education has therefore emerged as the ultimate resolution to continue education in Moroccan schools and universities. Indeed, the high penetration rates and widespread use of Internet among Moroccan households has also helped in the adoption of online learning by Moroccan educational institutes (El Firdoussi et al., 2020).

While online learning has contributed to broadening the access to education among different categories of students during the lockdown, there have been many concerns related to learning quality, access to technology and training for both students and instructors. Students’ satisfaction and academic achievement has also troubled parents, professors and policy makers (Jebbour, 2022). While a number of studies explored online learning outcomes among students in Western contexts (Belamghari, 2022), studies scrutinizing distance learning in developing countries are still very limited. Investigating Moroccan students’ attitudes, satisfaction and academic achievements in online learning settings is therefore of significant importance.

In reviewing extent literature, several gaps were identified. First, though online learning was the only resolution not to stop education during the lockdown, this teaching mode has been widely criticized by both students and instructors (Kundu and Bej, 2020). This led to a rising debate on whether schools and universities should consider online learning as a substitute to face-to-face learning in future years. The current research attempts to provide an understanding of students’ perceptions of online learning by investigating the main factors affecting students’ attitudes toward online learning, satisfaction and academic achievement. This will help instructors, universities and policy makers in understanding the students’ concerns and integrating online learning into educational programs more effectively. Second, while a large number of universities have incorporated online learning as a main component of their curricula, others are still struggling on how to get advantage from the online teaching mode, namely in less economically developed countries where online education is not yet prevalent. The findings of the current research could provide valuable insights to third-world
universities and decision-makers planning to incorporate online learning in their programs of studies. An extensive review of literature also suggests that while most studies investigating online learning have focused on developed nations, research investigating the trend in less advanced countries is still lacking (Castro and Tumibay, 2021; Mounjid et al., 2021). It was also found that though some research has examined the impact of online learning on academic achievement, the specific antecedents of online learning satisfaction and attitude have not been investigated enough in the post-pandemic era. The current study investigated online learning in a developing country that has quickly transitioned to online during the lockdown, but where debate on whether online learning represents a good alternative to traditional learning is still ongoing. Finally, most related studies have focused on specific factors to investigate the effectiveness of online learning. Still, their findings do not consider intercorrelated and varied elements that can influence, together, students’ satisfaction and academic achievement. Our study proposes a thorough conceptual model to examine the key factors explaining students’ attitude toward online learning, satisfaction and academic achievement. Our research also assesses the moderating effect of students’ motivation in achievement a better academic achievement. The above discussions signify the relevance of the current research.

The current study provides adequate knowledge to the on-going debate related to online learning adoption. Our findings also suggest valuable implications for Moroccan universities and higher education policymakers. Firstly, instructors’ performance is a significant driver of student satisfaction with online learning. Online instructors should receive adequate coaching and be equipped with sufficient support mechanisms to offer a better learning experience to students. This involves enhancing online resources, further training to both instructors and students and the development of enjoyable and interactive learning environments. Our findings also suggest IT ease of use and information quality as significant determinants of e-learning satisfaction. This suggests that the performance of the learning management system (LMS) quality is to be regularly monitored by the university decision-makers. Similarly, a robust audit and check of information and material quality is recommended. The recruitment of information technology (IT) experts may also improve the overall online learning experience. Finally, students’ satisfaction was found to be a key determinant of academic achievement. Universities must understand students’ needs by providing prompt resolutions to their queries and by electronically collecting their feedback on a regular basis. This will promote positive attitudes toward online learning and will lead to higher satisfaction among students. Policymakers may also employ the study’s findings to guide initiatives and programs that can enhance online learning in Moroccan higher education (HE) institutes. The rest of the current paper is organized as follows: Section 2 contains the literature review; Section 3 presents the methods used in the research, followed by Section 4 which covers data analysis and results. Discussion and conclusions are finally in Section 5 and limitations and future research in section 6.

2. Literature review

2.1 Theoretical foundation: TAM model

The technology acceptance model (TAM) represents an established theoretical foundation for technology adoption and use in a variety of contexts, including online learning. According to TAM, two key factors influence users’ behavioral intent when considering a technology: perceived usefulness (PU) and perceived ease of use (PEOU) (Davis, 1989). The TAM has been demonstrated to be a valuable model of foreseeing and explaining online learning behavior, with studies suggesting that PU and PEOU are both powerful determinants of students’ acceptance and use of platforms for online learning (Lei and So, 2021; Raza et al., 2021). TAM has been commonly used in online learning research and has been determined to be a successful model for predicting students’ acceptance and adoption of academic technologies (Teo, 2009).
2.2 Hypotheses development

Instructor performance reflects the extent to which the instructor is engaged in the delivery of information and knowledge along with empowering learners, delivering regular feedback and enabling collaborative effort (Webster, 1997). In the current study, the instructor’s perceived performance refers to the instructor’s presence to support students on their activities as well as treat them fairly (Mohammed et al., 2022). The performance of the instructor is among the most important factors influencing student satisfaction and performance (Munteanu et al., 2010). According to Gopal et al. (2021), instructor performance and learning outcomes are significantly linked. When the instructor’s performance is superior, students are more likely to be satisfied. Numerous factors could explain such a correlation. First, the instructor’s teaching approach and method can have a significant impact on student involvement and motivation (Lei and So, 2021). The instructor’s technological proficiency is another critical skill to enhancing students’ experience with online learning (Alea et al., 2020). The instructor-learner interaction is also key to enhancing students’ satisfaction (Ali and Ahmad, 2011). Not as in face-to-face classes that are generally based on lectures, online instructor’s major duty is to “guide on the side” and assist student active learning, rather than being the “sage on the stage” (Eom and Ashill, 2016). Prior research suggests a positive impact of the instructor performance and students’ satisfaction (Alfy and AbuKari, 2020; Badia et al., 2019; Bossman and Agyei, 2022). Accordingly, we presume that the instructor’s performance positively influence students’ attitude and satisfaction with online learning. Hence, the following hypotheses were formulated:

H1a. Instructor perceived performance positively impacts university students’ attitude toward online learning.

H1b. Instructor perceived performance positively impacts university students’ online learning satisfaction.

PEOU refers to users’ perceptions of how simple it is to adopt a system (Sun et al., 2008). In the present research, PEOU is defined as the level of effort needed by the student to undertake online learning classes. According to Devaraj et al. (2002), PEOU is a significant determinant of the user satisfaction. An individual is more likely to establish satisfaction and positive behavioral intention toward online interactions if they are viewed to be easy to use (Kerzić et al., 2021). Similarly, students’ perception of the ease of use of online platforms has a significant impact on online satisfaction (Wei and Chou, 2020). When individuals view an online experience to be simple to use, they are more likely to develop positive attitudes toward the experience. Past research has also affirmed a positive relationship between students’ ease of use and attitudes toward adopting online learning (Lei and So, 2021). Based on the above discussion, the following hypotheses were developed:

H2a. PEOU of the platform positively impacts university students’ attitude toward online learning.

H2b. PEOU of the platform positively impacts university students’ online learning satisfaction.

The quality of information refers to the knowledge that students use and benefit from (Miller, 1996). DeLone and McLean (2003) investigated the relationship between information quality and personal impacts as evaluated by accuracy, timeliness, completeness, relevancy and consistency. Bossman and Agyei (2022) found that information quality has a major and significant impact on university students’ satisfaction and attitude toward adopting online learning. Students are more likely to engage with the online learning system if they can find high-quality information that helps in understanding the course content. When evaluating online learning, students base their decision on the quality of the online course. Information quality is another key determinant of academic achievement in online learning (Pham et al., 2019). Rai et al. (2002) developed the
Seddon model by depicting PU, PEOU and information quality as main factors to user satisfaction. Bharati and Chaudhury (2004) confirmed information and system quality as significant predictors of decision-making satisfaction (Darawong and Widayati, 2022). We, therefore, develop the following hypotheses:

**H3a.** Information quality positively impacts university students’ attitude toward online learning.

**H3b.** Information quality positively impacts university students’ online learning satisfaction.

Interaction is generally described in as two-way mutual exchange of information between or among learners and instructors (Basuony et al., 2021). One of the major issues of online learning lower levels of interaction as opposed to face-to-face learning (Gray and Diloreto, 2016). Students feel disengaged from their instructors and classmates, which may negatively impact their motivation and academic achievements. Prior literature suggests that the online instructor-student interaction, along with student-student interaction and peer support, have a substantial impact on students’ learning outcomes and satisfaction (Eom and Ashill, 2016; Topal, 2016). In that same context, Rueda et al. (2017) convey those students engaging in online class-activities expressed higher satisfaction with the online learning experience. More recently, She et al. (2021) suggested a significant impact of interaction on student satisfaction with online learning. The authors explained that students who interacted with other classmates during the learning period are more comfortable and satisfied than those who do not. Still, other studies have failed to find a significant link between interaction and students’ online learning satisfaction (Baber, 2020; Ekwunife-Orakwue and Teng, 2014). Based on the above, the following hypotheses were developed:

**H4a.** Interaction positively impacts university students’ attitude toward online learning.

**H4b.** Interaction positively impacts university students’ online learning satisfaction.

PU is defined as a student’s belief that engaging in online learning would improve his or her academic performance (Teo, 2011). Saxena et al. (2021) emphasized that PU was found to be highly associated with students’ satisfaction in various virtual learning environments (low, medium and high levels of social presence). Similarly, Lei and So (2021) found that PU had a significant impact on students’ intention to adopt online learning. This implies that students are more inclined to take distance classes when they recognize it to be a beneficial and valuable method of learning. In a similar context, Ohliati and Abbas (2019) investigated factors influencing student satisfaction with online learning and confirmed PU as a key determinant of student satisfaction. Finally, Gao et al. (2020) revealed that PU was the strongest determinant of students’ motivation and satisfaction with online learning. Thus, the following hypotheses were proposed:

**H5a.** PU positively impacts university students’ attitude toward online learning.

**H5b.** PU positively impacts university students’ online learning satisfaction.

Attitude toward e-learning is described as the extent to which a student considers e-learning favorable or undesirable (Ajzen, 1991). Prior research reveals a positive relationship between satisfaction and attitude toward technology usage (Chang et al., 2015). It is argued that students’ satisfaction with past knowledge is mainly influenced by the attitude toward online education (Ngah et al., 2021). Similarly, Alqureshi (2016) convey that learners’ satisfaction with their educational experiences reflects their attitude toward the learning experience. Attitudes, awareness, procedures and equipment, motivation, learning environment and student achievement have all been found to influence student satisfaction (Ali et al., 2022; Muhsin et al., 2020). Thus, we hypothesize:
University students’ attitude toward online learning significantly impacts their satisfaction.

According to Veresova and Mala (2016), academic achievement reflects the student’s capacity to learn and master his lessons and to share his knowledge verbally or in writing. Many instructors, as evidenced by the study of Holubková and Glasová (2011), associate academic achievement with a student’s positive attitude toward learning, which may or may not be expressed in outstanding achievements, but will be reflected in the greatest personal performance in connection to a student’s behaviors. Students who perform poorly in class have a more negative attitude toward learning and assume that school and acquiring knowledge will not enable them to achieve their goals (Franco and Mendes, 2010). Veresova and Mala (2016) emphasize the importance of attitudes toward learning as a considerable determinant of academic achievement. Based on previous discussion, we propose the following:

H7. University students’ attitude toward online learning significantly impacts their academic achievement.

The level by which a learner’s perceptions about the teacher, class and instructional methods are fulfilled is referred to as student satisfaction (Rueda et al., 2017). In view the increasing popularity of online learning, investigating students’ level of satisfaction and how it relates to academic achievement of considerable importance (Khan and Javed Iqbal, 2016). Younas et al. (2022) investigated the relationships between students’ satisfaction and academic achievement and found a significant correlation. This was also confirmed by Rashidi and Moghadam (2014) who revealed that when satisfaction levels are high, schools witness an increase in student achievement. More recently, Darawong and Widayati (2022) convey those higher levels of satisfaction with online learning positively influence university students’ learning outcomes. Based on the above, the following hypothesis was developed:

H8. Students’ online learning satisfaction positively impacts their academic achievement.

Motivation is defined as a student’s desire to be involved in and accomplish classwork in order to succeed (Gray and Diloreto, 2016). According to Basuony et al. (2021), motivated learners are more likely to engage in complex activities, play an active role, engage in deep learning methods and demonstrate improved academic performance. Still, while intrinsic motivation impacts learning outcomes, it may not influence student satisfaction (Eom and Ashill, 2016). Students with higher academic accomplishments are usually excited to receive comments on their performance levels because they have made adequate goals. As a result, they are constantly pushing themselves to accomplish their objectives. This theory is appropriate for explaining students’ satisfaction with online courses (Adewale and Tahir, 2022). According to Gray and Diloreto (2016), motivation plays a crucial role in keeping students satisfied in an online class environment. That is, highly motivated students are more likely to outperform those with lower or no motivation. Accordingly, we presume that students’ motivation to study online moderates the relationship between online learning satisfaction and academic achievement and between attitude toward online learning and academic achievement. Hence, the following hypotheses were proposed:

H9a. Students’ motivation to study online moderates the relationship between online learning satisfaction and academic achievement.

H9b. Students’ motivation to study online moderates the relationship between attitude toward online learning and academic achievement.
Based on the above, the conceptual model illustrated in Figure 1 was established.

3. Methods
3.1 Measurement
All study constructs were adopted, with minor adjustments, from prior literature. The questionnaire scales and items were presented in French, as it is widely used among Moroccans (Chetioui et al., 2023). We also adopted the back-translation technique to translate the items from English to French (Lebdaoui et al., 2021). A five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree) was used to evaluate each variable. Demographic questions about gender, age, Internet quality/access, device used and educational level were included at the end of the questionnaire.

3.2 Sample and data collection
As a result of the global lockdown imposed by the COVID-19 pandemic, the Moroccan authorities have immediately decided transfer to distance learning on March 16, 2020. This has enabled a large share of Moroccan students to have access to education despite the lockdown. Still, while this mode of teaching was the ultimate resolution to support the government’s protective measures during these hard times, there have been many concerns related to quality, access to technology and training for both students and instructors (Jebbour, 2022). Though a number of studies explored online learning outcomes among students in Western contexts, studies scrutinizing distance learning in developing countries are still very limited (Belamghari, 2022). The current research aims to investigate the antecedents of students’ satisfaction and attitudes toward online learning as well as their impact on academic achievement in a developing nation context. The moderating effect of student motivation was also scrutinized.

For the practicality of this study, we opted for a nonprobability sampling technique combining self-selection and snowball sampling. An online self-administered questionnaire was shared with respondents via messenger, emails and WhatsApp. This allowed users to express their commitment to engage with the research (Saunders, 2012). As well, respondents

![Conceptual model](image)

**Figure 1.** Conceptual model

**Source(s):** Developed by the authors
were requested to share with other students with prior online learning experience. Given the large use of social media platforms among Moroccan Genz students, it was ascertained that the online survey was suitable. The online administration of the questionnaire was also considered appropriate since the target population comprises generation Z, recognized as digital natives (Chetioui and El Bouzidi, 2023). To make sure respondents have experience with online learning, a filter question was placed at the beginning of the questionnaire to exclude respondents with no familiarity with online classes. A total of 923 respondents successfully completed the questionnaire. 850 valid responses were maintained (92.09%), while 73 responses (7.91%) were rejected for the lack of online learning experience or for missing answers. The valid responses were analyzed to assess reliability, validity and appropriateness for hypotheses testing.

As illustrated in Table 1, our results suggest that the sample is made up of 395 (46.47%) males and 455 (53.53%) females. In terms of age, respondents aged between 18 and 25 represented the largest share of respondents with 645 respondents (75.88%), followed by those aged between 26 and 30 with 155 respondents (18.24%) and those who are 31 years old or more with 50 respondents (5.88%). As for educational level, 630 respondents (74.11%) either obtained or are still perusing a bachelor’s degree, 185 respondents (21.76%) obtained or are still perusing a master’s degree and 4.47% obtained or are still perusing PhD studies. Concerning the access to Internet quality, 90.82% conveyed they had a good quality of Internet while 9.18% of the respondents had limited access to Internet. Finally, with regards to the device used while studying online, 513 respondents (60.35%) used desktop or laptops, 273 respondents (32.11%) used smartphones and 64 respondents (7.54%) used tablets.

### 4. Results

To assess the proposed relationships in the study’s conceptual model, a structured equation modeling (SEM) was employed. The use of partial least squares (PLS) was considered most suitable for the current research due to the predictive nature of the theoretical framework and the complexity of the structural model and its relationships (Hair et al., 2019). Before testing

<table>
<thead>
<tr>
<th>Measure</th>
<th>Item</th>
<th>N</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>Male</td>
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<td>46.47</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>455</td>
<td>53.53</td>
</tr>
<tr>
<td>Age</td>
<td>18-25 y</td>
<td>645</td>
<td>75.88</td>
</tr>
<tr>
<td></td>
<td>26-30 y</td>
<td>155</td>
<td>18.24</td>
</tr>
<tr>
<td></td>
<td>31 years old and more</td>
<td>50</td>
<td>5.88</td>
</tr>
<tr>
<td>Internet quality/Access</td>
<td>Limited access</td>
<td>78</td>
<td>9.18</td>
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<td>Good quality</td>
<td>772</td>
<td>90.82</td>
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<tr>
<td>Device used</td>
<td>Desktop/laptop</td>
<td>513</td>
<td>60.35</td>
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<tr>
<td></td>
<td>Smartphone</td>
<td>273</td>
<td>32.11</td>
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<td>Tablet</td>
<td>64</td>
<td>7.54</td>
</tr>
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<td>Educational level</td>
<td>Bachelor’s degree or in progress</td>
<td>630</td>
<td>74.11</td>
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<tr>
<td></td>
<td>Master’s degree or in progress</td>
<td>185</td>
<td>21.76</td>
</tr>
<tr>
<td></td>
<td>Ph.D. or in progress</td>
<td>35</td>
<td>4.47</td>
</tr>
<tr>
<td>Cameras on during classes</td>
<td>It depends on the instructor</td>
<td>634</td>
<td>74.58</td>
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<td>No</td>
<td>180</td>
<td>21.18</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>36</td>
<td>4.24</td>
</tr>
<tr>
<td>Online learning experience prior to COVID-19</td>
<td>No</td>
<td>765</td>
<td>90</td>
</tr>
<tr>
<td></td>
<td>Yes</td>
<td>85</td>
<td>10</td>
</tr>
</tbody>
</table>

**Table 1.** Respondent profile (n = 850)

**Source(s):** Statistics calculated by the authors based on data collected from the sample respondents
the structural model, the measurement model was analyzed in terms of construct reliability, convergent and discriminant validity.

4.1 Assessment of the measurement model

As shown in Table 2, our findings demonstrate that all components have Cronbach’s alphas (CA) and composite reliabilities (CR) that are greater than or equal to 0.7, indicating that the variables are reliable (Henseler et al., 2009). Our results also indicate that all factor loadings exceeded the 0.7 threshold, confirming the items’ reliability (Chin, 1998; Hair et al., 2010; Henseler et al., 2009). Also, results demonstrate that all constructs’ average variance extracted values (AVEs) exceeded the 0.5 threshold, approving the model’s convergent validity.

The hetrottrait-monotrait ratio of correlations (HTMT) criterion has been used to assess the discriminant validity. Earlier literature has extensively utilized the HTMT as a more logical method of evaluating discriminant validity (Lebdaoui and Chetioui, 2020). All values in HTMT were below the cutoff of 0.9, which confirms the discriminant validity (Table 3).

As for the model fit, our findings demonstrate that our model’s standardized root mean squared residual (SRMR) value is 0.061 and is therefore below the threshold of 0.08 (Henseler et al., 2014), indicating a decent fit of the measurement model. The normed fit index (NFI) value is also above 0.9 (NFI = 0.915), indicating an acceptable fit. Lastly, all variation inflation factor (VIF) values are below the threshold of 3.3; the model is therefore free of pathological collinearity and of common method bias (Kock, 2015). The construct reliability, convergent validity, discriminant validity and model fit all produced adequate results therefore

<table>
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<tr>
<th>Constructs</th>
<th>Loadings</th>
<th>CA</th>
<th>CR</th>
<th>AVE</th>
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<th>Loadings</th>
<th>CA</th>
<th>CR</th>
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<td>Instructor perceived performance</td>
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<td>Academic achievement</td>
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<tr>
<td>IP1</td>
<td>0.899</td>
<td>0.887</td>
<td>0.747</td>
<td></td>
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<tr>
<td>IP2</td>
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<td>0.899</td>
<td>0.767</td>
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<td>IP3</td>
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<td>0.745</td>
<td></td>
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<tr>
<td>Ease of use</td>
<td>0.815</td>
<td>0.888</td>
<td>0.745</td>
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<tr>
<td>EOU1</td>
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<td></td>
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<td>ATT1</td>
<td>0.904</td>
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<td>ATT2</td>
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<tr>
<td>Information quality</td>
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<td>Student motivation</td>
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<tr>
<td>IQ1</td>
<td>0.823</td>
<td>0.799</td>
<td>0.734</td>
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<tr>
<td>IQ2</td>
<td>0.865</td>
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<td></td>
<td></td>
<td>IT1</td>
<td>0.714</td>
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<td>IQ3</td>
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<td></td>
<td>IT2</td>
<td>0.755</td>
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<tr>
<td>Interaction</td>
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<tr>
<td>INT1</td>
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<td>Online learning satisfaction</td>
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<tr>
<td>INT2</td>
<td>0.865</td>
<td></td>
<td></td>
<td></td>
<td>SAT1</td>
<td>0.899</td>
<td></td>
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<tr>
<td>INT3</td>
<td>0.855</td>
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<td></td>
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<td>SAT2</td>
<td>0.887</td>
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<tr>
<td>Perceived usefulness</td>
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<td></td>
<td>SAT3</td>
<td>0.791</td>
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<tr>
<td>PU1</td>
<td>0.866</td>
<td>0.766</td>
<td>0.787</td>
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</tr>
<tr>
<td>PU2</td>
<td>0.877</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PU3</td>
<td>0.865</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>

**Source(s):** Developed by the authors based on SmartPLS 4 output
### Table 3: Discriminant validity

<table>
<thead>
<tr>
<th></th>
<th>Academic achievement</th>
<th>Attitude towards online learning</th>
<th>Ease of use</th>
<th>Information quality</th>
<th>Instructor performance</th>
<th>Interaction</th>
<th>Online learning satisfaction</th>
<th>Perceived usefulness</th>
<th>Student motivation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Academic achievement</td>
<td>0.657</td>
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<tr>
<td>Attitude toward online</td>
<td>0.663</td>
<td>0.626</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>learning</td>
<td>0.699</td>
<td>0.700</td>
<td>0.700</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ease of use</td>
<td>0.556</td>
<td>0.544</td>
<td>0.561</td>
<td>0.611</td>
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<tr>
<td>Information quality</td>
<td>0.620</td>
<td>0.650</td>
<td>0.606</td>
<td>0.652</td>
<td>0.609</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Instructor performance</td>
<td>0.669</td>
<td>0.659</td>
<td>0.610</td>
<td>0.697</td>
<td>0.639</td>
<td>0.564</td>
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</tr>
<tr>
<td>Interaction</td>
<td>0.663</td>
<td>0.679</td>
<td>0.553</td>
<td>0.605</td>
<td>0.474</td>
<td>0.571</td>
<td>0.602</td>
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<tr>
<td>Online learning</td>
<td>0.663</td>
<td>0.702</td>
<td>0.537</td>
<td>0.699</td>
<td>0.529</td>
<td>0.699</td>
<td>0.670</td>
<td>0.723</td>
<td></td>
</tr>
<tr>
<td>satisfaction</td>
<td>0.663</td>
<td>0.702</td>
<td>0.537</td>
<td>0.699</td>
<td>0.529</td>
<td>0.699</td>
<td>0.670</td>
<td>0.723</td>
<td></td>
</tr>
</tbody>
</table>

**Source(s):** Developed by the authors based on SmartPLS 4 output
confirming that the suggested constructs can be adopted to assess the proposed conceptual model.

4.2 Assessment of the structural model
In order to evaluate the statistical value of the path coefficients, this research bootstrapped 5,000 resamples (Tenenhaus et al., 2005). As recommended by Hair et al. (2017), the coefficient of determination ($R^2$-square) and predictive relevance ($Q^2$-square) of our structural model were assessed. The coefficient of determination ($R^2$-square) must be greater than 0.33 to be regarded as reasonable (Chin, 1998). Our results suggest that the coefficient of determination was 63.25% for attitudes toward online learning, 52.5% for online learning satisfaction and 50.9% for academic achievement, implying a medium predictive power of the corresponding constructs. This was also reinforced by the positive values of $Q^2$-square. Tables 4 and 5 illustrate the main direct effects and indirect results respectively.

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Relationships</th>
<th>Beta</th>
<th>STDEV</th>
<th>T-statistics</th>
<th>P-values</th>
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</thead>
<tbody>
<tr>
<td><strong>Direct effects</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H1a</td>
<td>Instructor performance $\rightarrow$ Attitude towards online learning</td>
<td>0.293</td>
<td>0.033</td>
<td>5.055</td>
<td>0.000</td>
</tr>
<tr>
<td>H1b</td>
<td>Instructor performance $\rightarrow$ Online learning satisfaction</td>
<td>0.224</td>
<td>0.050</td>
<td>5.355</td>
<td>0.001</td>
</tr>
<tr>
<td>H2a</td>
<td>Ease of use $\rightarrow$ Attitude towards online learning</td>
<td>0.224</td>
<td>0.031</td>
<td>5.562</td>
<td>0.000</td>
</tr>
<tr>
<td>H2b</td>
<td>Ease of use $\rightarrow$ Online learning satisfaction</td>
<td>0.244</td>
<td>0.065</td>
<td>5.921</td>
<td>0.000</td>
</tr>
<tr>
<td>H3a</td>
<td>Information quality $\rightarrow$ Attitude towards online learning</td>
<td>0.240</td>
<td>0.051</td>
<td>5.955</td>
<td>0.000</td>
</tr>
<tr>
<td>H3b</td>
<td>Information quality $\rightarrow$ Online learning satisfaction</td>
<td>0.289</td>
<td>0.059</td>
<td>3.056</td>
<td>0.000</td>
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<tr>
<td>H4a</td>
<td>Interaction $\rightarrow$ Attitude towards online learning</td>
<td>0.238</td>
<td>0.038</td>
<td>2.575</td>
<td>0.001</td>
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<tr>
<td>H4b</td>
<td>Interaction $\rightarrow$ Online learning satisfaction</td>
<td>0.247</td>
<td>0.051</td>
<td>5.502</td>
<td>0.000</td>
</tr>
<tr>
<td>H5a</td>
<td>Perceived usefulness $\rightarrow$ Attitude towards online learning</td>
<td>0.346</td>
<td>0.032</td>
<td>5.591</td>
<td>0.000</td>
</tr>
<tr>
<td>H5b</td>
<td>Perceived usefulness $\rightarrow$ Online learning satisfaction</td>
<td>0.205</td>
<td>0.050</td>
<td>5.055</td>
<td>0.000</td>
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<tr>
<td>H6</td>
<td>Attitude towards online learning $\rightarrow$ Online learning satisfaction</td>
<td>0.324</td>
<td>0.063</td>
<td>5.997</td>
<td>0.000</td>
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<tr>
<td>H7</td>
<td>Attitude towards online learning $\rightarrow$ Academic achievement</td>
<td>0.374</td>
<td>0.050</td>
<td>7.551</td>
<td>0.000</td>
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<tr>
<td>H8</td>
<td>Online learning satisfaction $\rightarrow$ Academic achievement</td>
<td>0.233</td>
<td>0.051</td>
<td>2.623</td>
<td>0.009</td>
</tr>
</tbody>
</table>

**Source(s):** Developed by the authors based on SmartPLS 4 output

<table>
<thead>
<tr>
<th>Hypotheses</th>
<th>Relationship</th>
<th>Beta</th>
<th>STDEV</th>
<th>T-statistics</th>
<th>P-values</th>
</tr>
</thead>
<tbody>
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<td><strong>Moderating effects</strong></td>
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<td></td>
<td></td>
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<tr>
<td>H9a</td>
<td>Attitude towards online learning * student motivation $\rightarrow$ academic achievement</td>
<td>0.288</td>
<td>0.061</td>
<td>4.105</td>
<td>0.002</td>
</tr>
<tr>
<td>H9b</td>
<td>Online learning satisfaction * student motivation $\rightarrow$ academic achievement</td>
<td>0.244</td>
<td>0.034</td>
<td>3.731</td>
<td>0.001</td>
</tr>
</tbody>
</table>

**Source(s):** Developed by the authors based on SmartPLS 4 output

Table 4. Direct effects

Table 5. Indirect effects (moderating effects)
First, students’ attitude toward online learning was significantly influenced by instructor performance ($\beta = 0.293; p < 0.05$), Ease of use ($\beta = 0.224; p < 0.05$), information quality ($\beta = 0.240; p < 0.05$), Interaction ($\beta = 0.238; p < 0.05$) and PU ($\beta = 0.346; p < 0.05$), confirming H1a, H2a, H3a, H4a and H5a. Second, online learning satisfaction was mainly impacted by instructor performance ($\beta = 0.224; p < 0.05$), Ease of use ($\beta = 0.244; p < 0.05$), information quality ($\beta = 0.289; p < 0.05$), Interaction ($\beta = 0.247; p < 0.05$), PU ($\beta = 0.205; p < 0.05$) and attitude toward online learning ($\beta = 0.324; p < 0.05$), supporting H1b, H2b, H3b, H4b, H5b and H6. Finally, academic achievement was significantly influenced by attitude toward online learning ($\beta = 0.374; p < 0.05$) and Online learning satisfaction ($\beta = 0.233; p < 0.05$), confirming H7 and H8.

4.3 The moderating effect of student motivation
Ping’s (1995) approach was used to examine the moderating impact of student motivation developed in H9a and H9b. The first step, as recommended by Cortina et al. (2001), involves aligning all identifiers of the predictor factors (Xp) and moderator (Z), followed by the development of an entirely novel variable that reflects the significant association (sum of the standardized indicators of the independent variable multiplied by the sum of the standardized indicators of the moderator variable). The moderator (Xp * Z) is introduced as the final step to evaluate the structural model. Our results confirm student motivation as a moderator in the relationship between attitude toward online learning and academic achievement ($\beta = 0.288; p < 0.05$), confirming H9a. Student motivation was also found to moderate the relationship between online learning satisfaction and academic achievement ($\beta = 0.244; p < 0.05$), confirming the indirect effect hypothesized in H9b.

5. Discussion and conclusions
Students’ satisfaction with online learning can be associated with a higher likelihood of success in the learning process, which is more likely to translate into better academic achievement (Nikou and Maslov, 2023). Accordingly, it can be conceived as a key indicator of quality in higher education institutes. The assessment and evaluation of the factors influencing students’ satisfaction with online learning and how it contributes to academic achievement can provide a novel understanding of the fundamental instructional practices for a better online learning experience. The current research the key factors influencing Moroccan university students’ satisfaction and attitude toward online learning, as well as their impact on academic achievement. The moderating effect of students’ motivation to study online was also scrutinized. By examining these determinants, instructors can identify potential obstacles to online learning and develop strategies to enhance students’ satisfaction and academic achievement. Additionally, comprehending the impact of these factors on academic accomplishment can help in designing effective online learning strategies in Moroccan universities. Ultimately, the objective is to enhance the overall quality of online learning in Morocco and ensure a better learning experience for Moroccan university students.

First, our research confirms that the instructor’s perceived performance as a main determinant of students’ satisfaction and attitude toward online learning. This goes in line with the findings of prior studies that have consistently demonstrated that when instructors exhibit strong performance, students’ satisfaction and attitude toward the online learning experience (Sun et al., 2008). Our findings also corroborate earlier research that exhibits a positive association between PEOU and PU of online learning platforms and students’ satisfaction with online learning (Alqahtani and Rajkhan, 2020). Our results demonstrate that students who find the online learning platform easy to use and beneficial are more likely to develop positive attitude and satisfaction with the overall learning experience.
Another determinant of students’ attitude and satisfaction with online learning is the quality of online learning information. Our research findings go in line with previous studies that have established a correlation between information quality and students’ satisfaction and attitudes toward online learning (Ebner et al., 2019). Interaction with students was also proved to significantly impact students’ satisfaction and attitude toward online learning, which goes in line with prior research (Topal, 2016). Indeed, prompt feedback, good course design and interactive communication significantly affect students’ satisfaction and attitude toward online classes.

Our findings also propose attitude and satisfaction with online learning as key determinants of students’ academic achievement. Students with a positive attitude and satisfaction toward distance learning are more likely to reach a high educational achievement and performance. This is consistent with the findings of previous research (Veresova and Mala, 2016; Rueda et al., 2017; Khan and Javed Iqbal, 2016). Indeed, academic achievement is not only determined by the quality of content and delivery, but also by students’ attitude and satisfaction from online learning. Students are more likely to achieve good academic results when they develop a positive attitude toward online learning.

Finally, students’ motivation to study online was confirmed as a moderator in the relationship between attitude and academic achievement and between students’ satisfaction and academic achievement. These results are also aligned with the findings of previous research that exhibit that students with stronger motivation are more likely to achieve better academic results and achievement (Chen and Jang, 2010).

5.1 Theoretical implications
Our findings suggest numerous theoretical and practical implications. First, the current research suggests a multi-dimensional approach to understand and explain students’ satisfaction and attitude toward online learning in the context of Moroccan university students. We also contribute to the extent of literature by exhibiting that multiple factors are responsible for students’ satisfaction, attitude and performance in the context of online classes during the COVID-19 pandemic. Particularly, students’ satisfaction and attitude toward online learning are mainly influenced by instructor performance, ease of use of the platform, information quality, interaction and PU of online learning. The current study was considered novel as none of the previous studies had examined the effect of students’ satisfaction and attitude on academic performance. As well, while a number of studies have investigated the factors affecting student attitude, satisfaction with online learning and academic achievement (Maqableh et al., 2021; Yunusa and Umar, 2021), no prior research has examined the effect of the quality of instructor, ease of use of the platform, information quality, interaction and PU all together with online classes during the pandemic period. We also investigated the moderating effect of student motivation in achieving good academic results. Our study took into consideration factors that are related to the instructor, the platform and the student.

5.2 Practical implications
First, our findings emphasize the important role of instructors in shaping students’ attitude and satisfaction with online learning. During the lockdown, instructors had extra obligations and requirements. In addition to shaping course design and delivery mode, they had to work on improving their technical skills and digital literacy, adapt to a changing situation and ensure a good online learning experience for students. This confirms that instructor attributes are key to students’ attitude and satisfaction during online classes. Such attributes incorporate factors related to content and pedagogical knowledge, motivation and expertise (Gopal et al., 2021). Hiring and training quality instructors is therefore key to academic success of students.
Our findings could also be valuable to instructors by illuminating a viable approach to boost students’ satisfaction and academic achievement in online learning settings. While delivering online, instructors ought to make sure to provide quality content to attract students’ attention and engagement. Our results also indicate that instructors’ interactivity with students is key to students’ satisfaction and achievement. Instructors are therefore encouraged to promptly reply to questions, provide timely feedback on assignments and exams and to encourage students to participate during classes to help students in online courses. Furthermore, as most students expect employment after graduation, instructors should do their best to fulfill students’ employment expectations (Gorgodze et al., 2020).

Our findings could also be used by relevant authorities, namely the Education Ministry, University boards and the universities themselves. Such authorities ought to take initiatives to arrange hands-on workshops and programs to disseminate digital literacy among both instructors and students. Such initiatives can enhance online courses delivery as well as students’ performance and academic achievement. Finally, and for a better quality and delivery of courses, instructors should also be provided with necessary system infrastructure that is appropriate for interaction with and between students.

Finally, taking into consideration the study finding, we highly recommend the introduction of a solid-blended learning system. Students are more likely to embrace online learning tools if they are satisfied with their learning output. Developing digital platforms through which instructors can teach without barriers is key to enhancing students’ satisfaction and academic achievements. Similarly, investing in the necessary infrastructure for online learning is key to enhancing universities’ ability to provide high-quality e-learning education to their students.

6. Limitations and future scope of the study
Despite the exciting theoretical and practical implications of the current research, it is still subject to a few limitations. First, the data used were collected from students using self-selection and snowball sampling. The use of a nonprobability sampling technique can be criticized. Still, adopting a probability sampling method was not practical in our framework. Second, data was collected only from students. Hence, our results may not be generalized to other samples. Future research may also consider the perceptions of instructors and policy makers to boost the generalization of the results. The study was also conducted with students of only one developing country. To overcome social and cultural disparities, comparable research is to be conducted in other contexts for comparison of outcomes. Finally, it would be interesting to conduct a qualitative study with both students and instructors to get deeper insights and assess online learning from different perspectives.

References


Students’ achievement in online learning


**Further reading**


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