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Technological factors of students' persistence in online courses in higher education: The moderating role of gender, age and prior online course experience

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Abstract

The aim of this study was to verify if technological factors have an influence on persistence in online courses. A theoretical model encompassing seven variables was tested, some of them borrowed from the Unified Theory of Acceptance and Use of Technology: performance expectancy, effort expectancy, social influence, facilitating conditions, attitude, anxiety and persistence in online courses. Three moderating variables (gender, age and prior online course experience) were also considered in the analyses. Data were collected among a sample of 430 students using an online questionnaire. The obtained results strongly support 6 of the 9 research hypotheses for the proposed model. Correlations revealed significant associations between persistence in online courses on the one hand and performance expectancy, effort expectancy, social influence, facilitating conditions, attitude, and anxiety on the other hand. A series of multiple linear regressions examined the predictability of persistence in online courses by the technological factors considered in the study for the whole sample, and for each gender, age and prior online course experience group. They showed that these factors explained 18.9% to 45.7% of the variability in persistence in online courses. The discussion focuses on how different technological factors explain persistence.

Keywords UTAUT model · Attitude · Anxiety · Gender · Age · Prior online course experience · Persistence · Online courses · Higher education

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1 Introduction

Over the past two decades, the number of online courses has grown considerably in higher education (Myers and Schiltz 2012; Rodríguez-Ardura and Meseguer-Artola 2016; Shea and Bidjerano 2014). The number of enrollments in higher education institutions offering such courses and the increasing worldwide market for online course products and services has also followed this trend (Lee 2017). For example, a recent report by Allen et al. (2016) revealed that in 2014, a total of 5.8 million students were registered in online courses in the United States. A recent Canadian survey (Donovan et al. 2019) revealed that the proportion of Canadian higher education institutions offering online courses grew to 83% in 2018, and it is expected to expand further in the future. Moreover, Lee et al. (2013) added that the worldwide market reached over $27.1 billion in 2009 and was expected to attain $49.6 billion by 2014 for online course products and services. The growth of these courses is due to several factors. First, they meet the demands of students who desire flexible course schedules, especially those of adult students. Also, they give them better access to higher education; these students would not attend face-to-face courses, because of family and/or work responsibilities, not to mention their distance from higher education institutions (Lakhal 2019). Finally, they significantly decrease their educational costs. Indeed, these students would no longer need to travel to attend face-to-face sessions while benefiting from direct or indirect contact with the teacher and with other students (Cidral et al. 2018; Wang and Hsu 2008). Moreover, online courses provide higher education institutions with some financial benefits (Gosmire et al. 2009; Yoo and Huang 2013) and they appear to be at least as effective as face-to-face courses. An often-cited meta-analysis of 232 comparative studies conducted by Bernard et al. (2004) concluded that, overall, online courses and face-to-face courses are comparable on some student outcomes (academic performance and satisfaction). However, these results also revealed great variability. Furthermore, promising news has been reported by a meta-analysis of 51 studies comparing students enrolled in online courses and face-to-face courses (U.S. Department of Education 2010). The study revealed that academic performance was higher for online students as compared to those registered in face-to-face courses. A more recent meta-analysis by Means et al. (2013) continues to confirm these results.

That said, several studies reported that persistence rates in online courses are very low. They range between 30% and 50% according to Kranzow (2013). Moreover, online courses present lower persistence rates than face-to-face courses (Arhin and Wang'eri 2018; Cho 2012; Herbert 2006; Lee and Choi 2011; Lee et al. 2013; Mahmodi and Ebrahimzade 2015; Park and Choi 2009). Students' persistence in online courses is perceived as one of the biggest weaknesses of this course delivery mode (Herbert 2006). Dropout from online courses is described as a difficult and embarrassing phenomenon, as a dropout experience lowers students' confidence in learning and causes failure, social isolation and financial loss (Lee et al. 2013). Thus, with the exponential increase in the number of online courses in higher education, students' persistence in these courses is of great concern.

The determinants of students' persistence in online courses in higher education have been studied by some authors and have been defined in some models. Regarding studies on this matter, Lee and Choi (2011), in a review, classified these determinants into three categories:

1) those related to students (academic background, relevant experiences, skills, and psychological attributes), 2) those on courses and programs (course design, institutional support and interactions) and 3) those associated with the environment (work commitment and supportive environment). In another review conducted on studies in the field of nursing education, Gazza and Hunker (2014) classified these determinants into three categories: 1) Social presence, 2) Program and course quality, and 3) Individual student characteristics. Regarding models, the best known for this purpose are those of Ajzen (1991), Kember (1989), Park (2007) and Rovai (2003). Ajzen (1991) examined the influence of psychological factors on persistence, while Kember (1989), Park (2007) and Rovai (2003) adopted the perspective of student-institution adequacy, derived from Tinto's (1975, 1993) model. However, none of these reviews or models have put special emphasis on technological factors (Lakhal and Bazinet 2015; Lakhal 2019). And yet, technologies are very important in implementing and delivering instruction in online courses; students' experience with these courses as well as technological issues should be a very significant predictor of persistence in online courses and even in subsequent courses (Hachey et al. 2014; Joo et al. 2011b; Lakhal and Bazinet 2015; Lakhal 2019; Packham et al. 2004). Moreover, the characteristics of the technologies used are even crucial for influencing online learning (Arbaugh 2014). Familiarity with these technologies has been reported as a major factor in student success in online courses (Cho 2012). In this regard, Arbaugh (2014) claims that "there are opportunities for stronger measures of technological characteristics in future studies" (p. 358). By technological characteristics, he refers to technological factors of the Technology Acceptance Model (TAM) model (Davis 1989). In these contexts, the TAM model specially deals with online course systems' acceptance and use. In this regard, previous research has been well served by frameworks from information system literature. Prior studies have often used the TAM model (Davis 1989), according to the results of a meta-analysis by Šumak et al. (2011) based on 42 research papers, and more specifically, perceived usefulness, perceived ease of use and attitude in predicting acceptance and use of online course systems. More recent studies continue to confirm these findings (Arbaugh 2014; Hsu et al. 2016; Islam 2013; Islam and Azad 2015). However, "when the TAM variables have been incorporated into broader frameworks of online course effectiveness, their predictive ability has been much less consistent" (Arbaugh 2014, p.350). Perceived usefulness and perceived ease of use of the TAM model have not consistently predicted online course outcomes in previous research. For these reasons, as we consider persistence in online courses to be one of these outcomes, in the present study, we used the model of Venkatesh et al. (2003), known as the Unified Theory of Acceptance and Use of Technology (UTAUT) model, to define the technological factors. The choice of this model comes from the fact that it represents an integrative and a global model, derived from the main competing previous models and theories developed to explain technology acceptance by its users (Ajzen 1991; Compeau and Higgins 1995; Davis 1989; Davis et al. 1989, 1992; Fishbein and Ajzen 1975; Moore and Benbasat 1991; Schifter and Ajzen 1985; Taylor and Todd 1995; Thompson et al. 1991), including the TAM model.

Thus, the aim of this paper is to verify if the technological factors of Venkatesh et al. (2003) could explain students' persistence in online courses in higher education. According to Venkatesh et al. (2003), the UTAUT model should be enriched with additional determinants, such as task technology fit and individual constructs. Among these latter constructs, attitude and anxiety are taken into account in the present research as they were integrated into previous studies assessing either the determinants of use of technologies or the effect of use

on students' outcomes (Bozionelos 2004; Khechine and Lakhal 2015, 2018; Mcilroy et al. 2007). Hence, this study incorporates a variety of explanatory variables: performance expectancy, effort expectancy, social influence, facilitating conditions, attitude and anxiety. Moreover, the UTAUT model also incorporates moderating variables: gender, age and experience. These moderating variables are taken into account in the present study. Reviewing technological factors that might explain persistence in online courses is an important issue, as it would provide administrators and higher education faculty members with guidance in how to implement these courses in reference to the results of empirical studies. Based on our research, higher education institutions might best prioritize their investments in elements of online courses such as design and factors found in the present study that had most impact. In this vein, our research results should point out the most important technological determinants of persistence in online courses in higher education. Moreover, in the short term, special assistance could be provided to dropout-prone students in relation to these specific factors. In the long term, an online student orientation could be developed based on knowledge of these factors (Cho 2012). From a conceptual point of view, based on the results of this study, an explanatory model on persistence in online courses is built and tested empirically, and support is found for the causal relationships of which it is composed.

2 Conceptual framework, literature review and study hypotheses

2.1 Online courses

For the purpose of this article, online courses are courses offered by higher education institutions using the Internet and/or web technologies to support teaching, learning and assessment activities. These courses generally use online course systems that integrate technological tools to support these activities and interactions between the instructor and students and between the students themselves. These courses refer to any form of teaching and learning activities distributed across time and space and do not always require instructors and students to be grouped together in the same place at the same time (Lakhal 2019). According to Allen and Seaman (2013), in an online course, 80% of teaching and learning activities are offered online. This percentage may vary from one author to another and from one higher education institution to another (Lakhal and Meyer 2019).

2.2 Persistence in online courses

Regarding persistence in online courses, authors and institutions in higher education do not agree on a single definition (Lee and Choi 2011). Moreover, the definitions provided were not consistent from one author to another. Some of them for example have defined it as: 1) the intention to finish the online course in which the student is enrolled, 2) the intention to enroll in other online courses in the future, or 3) students' intention to remain enrolled in the online course after the add/drop period (Lee and Choi 2011). Persistence in online courses has also been defined as "that state in which learners continually participate in their educational programs and complete their courses, processes, and degrees to arrive at their educational goals" (Joo et al. 2011a;

p. 715). In the present study, we define persistence as intent-to-persist in the online course in which the student is enrolled.

2.3 Technological factors

As, to our knowledge, very few authors have examined technological factors in explaining persistence in online courses (Chiu and Wang 2008; Joo et al. 2011b; Lakhal 2019), we borrowed information system acceptance literature in order to build our research hypotheses in the following subsections. In previous studies taking into account technological factors, authors considered behavioural intention and use of online course systems as dependent variables, and named them "continuance intention in web-based learning" (Chiu and Wang 2008) and "continuance intentions in online courses" (Alraimi et al. 2015; Ouyang et al. 2017; Rodríguez-Ardura and Meseguer-Artola 2016; Wu and Chen 2017; Yang et al. 2017). For these authors, web-based learning refers to online courses offered by higher education institutions, and continuance intention to the subjective probability that students will continue using online course systems. However, acceptance and use of online course systems is a different concept from persistence in online courses and may be considered as a predictive variable of the latter. In fact, the more a student is willing to use the online course system, the more he/she might persist in online courses (Lakhal 2019). Some of these studies are presented in Table 1.

2.3.1 Performance expectancy

Performance expectancy can be defined as the degree to which a student believes that using an online course system will help him/her attain a higher level of academic performance (Venkatesh et al. 2003). This construct is similar to perceived usefulness of the TAM model. The results of a study using the UTAUT model (Chiu and Wang 2008) and a meta-analysis by Šumak et al. (2011) revealed a positive effect of performance expectancy on behavioural intention to use an online course system, with a maximum significant positive path coefficient of 0.85, a minimum of 0.13 and an average of 0.40, based on 28 studies. This result continues to be confirmed by recent studies in the context of online courses (See Table 1). Joo et al. (2011b) also reported a positive effect of perceived usefulness on persistence in online courses, but this effect was indirect. In the same vein, if a student expects the use of an online course system to improve his/her academic performance, he/she will have a positive attitude toward the system in question, which increases his/her intention to persist in that course. The first research hypothesis can thus be stated as follows:

> H_{PE}: Performance expectancy has a positive impact on persistence in online courses.

2.3.2 Effort expectancy

Effort expectancy refers to the degree of ease, as perceived by the student, associated with the use of online course system (Venkatesh et al. 2003). It is similar to the

Table 1 Studies on continuance intention to use/use online course system Study

	Sample	Correlations with continuance intention to use/use online course system					
		PE	EE	SI	FC	Attitude	Anxiety
Alraimi et al. (2015)	$n = 316$, 74 countries	.18**					
Cheng (2014)	$n = 378$, Taiwan	.22**					
Chiu and Wang (2008)	$n = 286$, Taiwan	.12*	.15*	NS	NS	–	−.17*
Damnjanovic et al. (2015)	$n = 255$, Serbia, Lithuania, Bosnia and Herzegovina	.20*					
El-Masri and Tarhini (2017)	$n = 418$, Qatar	.19**	.12**	.14**	NS		
	$n = 389$, USA	.20**	NS	NS	.10*		
Hsu et al. (2016)	$n = 119$, Taiwan.	.35**	.32**				
Islam and Azad (2015)	$n = 185$, Finland	.22* (indirect)	.30**				
(indirect)							
Islam (2013)	$n = 249$, Finland	.50**	.22**				
Lakhal (2019)	$n = 61$, Canada	NS	NS	NS	.66**		
Lin et al. (2011)	$n = 230$, Taiwan	.34**					
(indirect)	.23** (indirect)			.65**			
Mohammadyari and Singh (2015)	$n = 34$, New Zealand	.39**	NS	.32**			
(indirect)							
Ouyang et al. (2017)	$n = 234$, China	.20*					
Rodríguez-Ardura and Meseguer-Artola (2016)	$n = 2530$, Europe	.66**					
(indirect)	.14** (indirect)			.87**			
Tarhini et al. (2017)	$n = 366$, Britain	.26**	.12*	.23**	NS		
Wu and Zhang (2014)	$n = 284$, China	.58**	.65**				
(indirect)	.29** (indirect)		1.18**				
Wu and Chen (2017)	$n = 252$, China	.47*	.32**				
(indirect)	.13** (indirect)		.51**				
Yang et al. (2017)	$n = 294$, China	.29**	.33**				

Notes: PE: performance expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions. * $p < 0.05$, ** $p < 0.01$, NS: non-significant

perceived ease of use of the TAM model. Šumak et al. (2011) reported a positive effect of effort expectancy on behavioural intention to use an online course system, with a maximum significant positive path coefficient of 0.41, a minimum of 0.12 and an average of 0.24, based on the results of 14 studies. This positive effect continues to be confirmed by recent studies (see Table 1). Joo et al. (2011b) also reported a positive

effect of perceived ease of use on persistence in online courses, but this effect was indirect. Since increased effort expectancy leads to increased performance, if students perceive that it is easy to use an online course system, this might encourage them to persist in online courses (Chiu and Wang 2008). Accordingly, the second research hypothesis can be stated as follows:

H_{EE}: Effort expectancy has a positive impact on persistence in online courses.

2.3.3 Social influence

Social influence describes the degree to which students perceive that people important to them believe they should use an online course system (Venkatesh et al. 2003). Venkatesh et al. (2003) reported that social influence had a positive effect on behavioural intentions to use a technology in a workplace. This result was confirmed in a recent meta-analysis by Khechine et al. (2016). In the context of acceptance and use of online course systems, recent studies (see Table 1) reported a positive direct or indirect effect of social influence on behavioural intention. According to Chiu and Wang (2008), the more favourable the social influence on a behaviour, i.e., the use of an online course system, the stronger the student's intention to perform it. Moreover, students tend to increase their communications with others in order to better understand how the online course system works. These communications may also influence their decision to persist in online courses. Based on previous evidence, we formulate the research hypothesis as follows:

H_{SI}: Social influence has a positive impact on persistence in online courses.

2.3.4 Facilitating conditions

Facilitating conditions refers to the degree to which a student believes that an organizational and technical structure exists to support the use of an online course system (Venkatesh et al. 2003). Venkatesh et al. (2003) reported that facilitating conditions had a positive effect on the use a technology in a workplace. Khechine et al.'s (2016) meta-analysis, based on 28 studies using the UTAUT model, also confirmed this result. Applied to online course systems, El-Masri and Tarhini (2017) reported a positive effect of facilitating conditions on behavioural intention. However, other studies failed to report any significance to this effect (see Table 1). According to Chiu and Wang (2008), facilitating conditions enhance students' adoption of a behaviour, i.e., the use of an online course system. The more a student believes that technical problems with online course systems, if any, would be quickly solved by an organizational and technical structure, the more he/she will be willing to persist in online courses. Based on previous evidence, we formulate the research hypothesis as follows:

H_{FC}: Facilitating conditions have a positive impact on persistence in online courses.

2.3.5 Attitude towards online course systems

Attitude is a learned predisposition to respond to a given object in a consistent manner. This response could be positive or negative. In both Theory of research action (Fishbein and Ajzen 1975) and Theory of planned behaviour (Ajzen 1991; Fishbein and Ajzen 1975), beliefs affect attitudes, which in turn have an influence on users' intentions (Ajzen 1991). Here, attitude serves as an evaluative predisposition to behaviour. Previous studies reported that attitude is a strong predictor of online course continuance intention (see Table 1). Attitude towards online course systems may predict student's intention to persist in online courses. Positive attitude towards online course system may facilitate student's persistence in online courses. On the contrary, negative attitude towards an online course system may negatively affect a student's decision to persist in online courses. We formulate the research hypothesis as follows:

> H_{AUT}: Positive attitude towards online course system has a positive impact on persistence in online courses.

2.4 Anxiety

Anxiety can be defined as the apprehension or discomfort a student experiences with respect to technologies. This negative affective response of students towards technologies has received a great deal of attention in technology adoption studies, according to Powell (2013), based on a meta-analysis of 276 studies. Anxiety is characterized by an affective response, an emotional fear of potential negative outcomes. Such negative feelings reduce performance and may have a negative effect on persistence in online courses (Chiu and Wang 2008). On this subject, Abdous (2019) reported that students' anxiety is inversely correlated with learning effectiveness, and "negative emotions and beliefs appear to form a significant roadblock to online students' academic persistence and success" (p. 34). Moreover, research in psychology has confirmed that anxiety makes students physically avoid the stressor or engage in exit strategies (Beaudry and Pinsonneault 2010), detracting from the effort necessary to cope with the situation (Carver et al. 1989; Yi and Baumgartner 2004), i.e., to persist in online courses. As for technology adoption in online courses, Khechine and Lakhal (2018) reported a negative effect of anxiety on use behaviour. Chiu and Wang (2008) revealed a negative impact of anxiety on persistence in online courses. A recent study by Stiller and Köster (2016) revealed similar results. The research hypothesis can thus be stated as follows:

> H_{ANX}: Anxiety has a negative impact on persistence in online courses.

2.5 Moderating variables: Gender, age and prior online course experience

In the design of the present study, gender, age and prior online course experience were considered as moderator variables. A moderator variable is a qualitative or quantitative variable that affects the significance, direction and/or the strength of the relationship between two other variables (Baron and Kenny 1986). Venkatesh et al. (2003) reported

that gender, age and experience played a moderating role in the relationship between performance expectancy, effort expectancy, social influence and facilitating conditions on the one hand, and behavioural intention to use online course systems on the other hand. More recent information system acceptance literature provides strong evidence of these significant moderating effects (Lakhal et al. 2013; Khechine et al. 2014; Lin 2011).

In Rovai's (2003) model, gender and age have an influence on students' persistence in online courses. However, the nature of the relationship between gender, age and persistence was not explained. According to Park (2007), there is no consensus on the direct influence of these students' characteristics on persistence. They suggest that these determinants should be considered as moderating factors. Recent studies reported mixed findings on the relationship between gender and age on the one hand and persistence in online courses on the other hand. With regard to gender, several authors revealed that women were more likely to persist in online courses than men (Mahmodi and Ebrahimzade 2015; Sultan and Hagger 2013). However, other authors reported the opposite: for Stoessel et al. (2015), using a binary-logistic multiple regression analyses, women exhibited higher risks to drop out from university than men. Moreover, Krajewski (2015) found a non-significant relationship between gender and persistence in online courses. As for age, Park and Choi (2009) reported a non-significant relationship between age and persistence. Krajewski (2015) revealed that older students were more persistent than younger ones. Mahmodi and Ebrahimzade (2015) and Sultan and Hagger (2013) have found the opposite: older students were less persistent than younger ones.

With regard to prior online course experience, according to a review by Lee and Choi (2011), researchers found that the number of previous online courses completed was an important predictor of persistence in online courses. More recent studies continue to confirm this result (Hachey et al. 2014). A study by Abdous (2019) uncovered that the higher the number of online courses previously enrolled in, the lower the students' anxiety in the online course, thus enhancing students' disposition to learn online and to persist. However, other studies failed to find a significant relationship between prior online course experience and persistence (Stiller and Köster 2016).

Given these mixed findings in regard to gender, age and prior online course experience, we suggest that men and women, students belonging to different age groups and those belonging to different prior online course experience groups will exhibit different patterns of relationships. Three research hypotheses are stated for students' gender, age and prior online course experience as follows:

> H_{GEND}: there is a difference in the patterns of significant relationships in the two models per gender group (the model for men and the model for women).
> H_{AGE}: there is a difference in the patterns of significant relationships in the two models per age group (the model for younger students and the model for older students).
> H_{EXP}: there is a difference in the patterns of significant relationships in the two models per prior online course experience group.

The study model and hypotheses are depicted in Fig. 1.

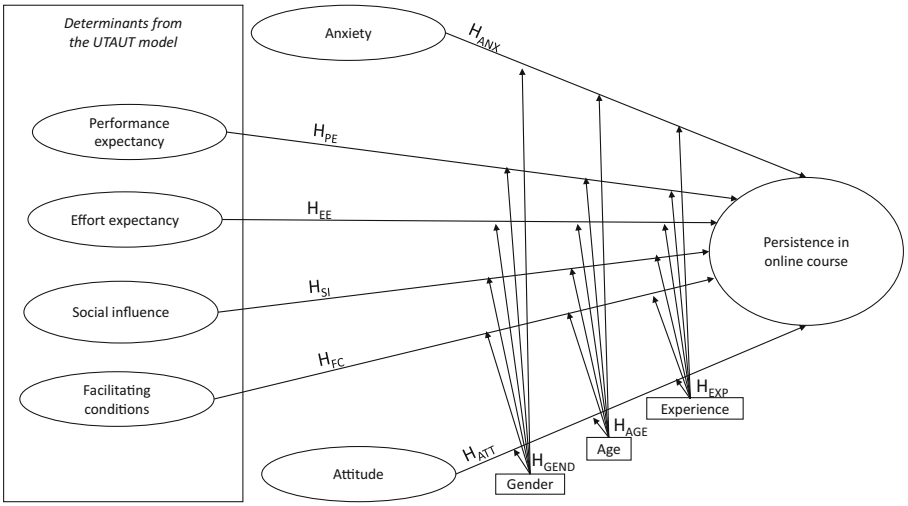

Fig. 1 The study model and hypotheses

3 Methodology

3.1 Procedure

The data used to test the model of the present study were obtained from a large well-established French-speaking university in Quebec, Canada, offering courses in three modes: online, blended and face-to-face. The online courses are our subject of interest, as we aim, in this study, to verify if technological factors could explain students' persistence in these courses. In this university, in all online courses, a system is used in order to make teaching, learning and assessment activities, course content and other technological tools (e.g., web videoconferencing platform) available to students. This online course system is a homemade system, as opposed to a commercial one (such as WebCT, Moodle, etc.). It was designed following a course outline-based approach, which effectively structures a course website and allows students to better plan their schedules. By completing the different sections of their online course system, instructors generate a printable digital copy of their course outline. The user-friendliness of the online course system and the grouping of different digital resources in one place are among the advantages most appreciated by instructors and students. The interconnections with the academic management system and other information systems ensure that relevant course information is constantly updated. Through the online course system, a student can easily check the availability of a compulsory volume at the Library, and only needs to log in once to be able to access their email and their course websites.

At the beginning of the 2016 winter semester, ethics approval was secured from the ethics review board of the university where the study took place (UL-2016-035). Then the information technology department was contacted and asked to provide a mailing list of all the students enrolled in online courses. The mailing list was used by the researchers to reach all these students. In the email, the purpose of the study and the potential involvement of the students were explained. A link to the online questionnaire was also embedded in the email. Students' participation was voluntary. The

questionnaire used in this study took 15 to 20 min to complete. It was put online during the final five weeks of the 2016 winter semester. To encourage students' participation, six $50 gift certificates were randomly drawn at the end of data collection. During the data collection period, an email reminder was sent to students inviting them to participate in the study.

3.2 Participants

The participants were students enrolled in online courses in the 2016 winter semester. A total of 545 voluntary students answered an online questionnaire. After filtering, 115 questionnaires were eliminated due to incomplete responses, yielding a sample size of 430 usable responses for the study analysis. Among these 430 students, there were 99 men and 331 women, 237 students aged 25 years and younger and 193 aged 26 years and older, 201 who had enrolled in 3 or fewer online courses and 229 who had enrolled in 4 or more online courses at the beginning of the 2016 winter semester.

3.3 Measures

Items for the constructs considered in the study were selected and adopted from previous research. Some items were dropped or modified from the original research to better fit the context of the present study, and then scales were translated into French. All items were rated on a seven-point Likert-type scale (from 1 = strongly disagree to 7 = strongly agree). Performance expectancy, effort expectancy, social influence, facilitating conditions and attitude were measured through items adapted from Venkatesh et al. (2003), Lakhal (2019), Lakhal and Khechine (2017) and Khechine and Lakhal (2018). As for anxiety, items were borrowed from the Computer Anxiety of the Computer Attitude Scale (Loyd and Gressard 1984; Loyd et al. 1987), and the Anxiety scale of Venkatesh et al. (2003). Persistence in online courses was measured by means of a scale developed by Strevy (2009), Lint (2013) and Lakhal (2019). The list of scale items before translation is presented in Table 2. In the online questionnaire, students were also asked to identify their gender and age. As for prior online course experience, students were asked to identify the number of online courses they had enrolled in so far.

4 Results

4.1 Internal consistency, descriptive statistics and t-tests

The first step of the data analysis was to assess reliability by means of a confirmatory factor analysis and item loadings. The results showed that item loadings on each construct were strong (>0.5, as recommended by Nunnally, 1978), except for SI4, SI5, SI6, Anx1, Anx3, Anx6, Pers3 and Pers7. These items were dropped from respectively the social influence, anxiety and persistence scales. A Cronbach Alpha coefficient was then computed for each construct in order to verify the internal consistency of the scales used and to make sure that they adequately measured the core construct (Crocker and Algina 1986; Cronbach 1951). These coefficients are presented in Table 3. Cronbach Alpha coefficient

Table 2 List of scale items

Performance Expectancy	
PE1	Using the online course system improves my performance in my learning activities.
PE2	I find the online course system useful for my learning activities.
PE3	Using the online course system enables me to accomplish my learning activities more quickly.
PE4	Using the online course system improves the quality of my learning activities.
PE5	Using the online course system makes my learning activities easier.
PE6	Using the online course system enhances my effectiveness in my learning activities.
PE7	Using the online course system increases my productivity in my learning activities.
PE8	Using the online course system allows me to integrate the useful knowledge in my learning activities more quickly.
PE9	If I use the online course system, I will increase my chances of getting higher marks on tests and exams.
PE10	The variety of technologies available in the online course system is useful for my learning activities.
Effort Expectancy	
EE1	Learning to operate the online course system will be easy for me.
EE2	My interaction with the online course system will be clear and understandable.
EE3	It will be easy for me to become skillful at using the online course system.
EE4	I will find the online course system easy to use.
Social Influence	
SI1	People who influence my behaviour think I should use the online course system.
SI2	People who are important to me think I should use the online course system.
SI3	I use the online course system because several of my colleagues use it.
SI4*	The teacher of this course is helpful in the use of the online course system.
SI5*	The teacher encourages me to use the online course system.
SI6*	In general, the university has supported the use of the online course system.
SI7	In my class, students who use the online course system enjoy more prestige than those who do not.
SI8	In my class, students who use the online course system have a high profile.
SI9	Using the online course system is academically status-enhancing for students.
Facilitating Conditions	
FC1	I have the resources necessary to use the online course system.
FC2	I have the knowledge necessary to use the online course system.
FC3	The online course system is compatible with other systems I use.
FC4	A specific person is available for assistance with the online course system difficulties.
FC5	Using the online course system fits my learning style.
FC6	Using the online course system is compatible with all aspects of my work.
FC7	I think that using the online course system fits well with the way I like to work.
Attitudes	
AUT1	Using the online course system is a good idea.
AUT2	Using the online course system makes learning activities more interesting.
AUT3	Using the online course system is pleasant.
AUT4	Using the online course system makes learning more interesting.

Table 2 (continued)

Performance Expectancy	
AUT5	I have fun using the online course system.
Anxiety	
Anx1*	The online course system does not scare me at all.
Anx2	Working with the online course system makes me nervous.
Anx3*	I do not feel threatened when others talk about the online course system.
Anx4	The online course system makes me feel uncomfortable.
Anx5	I get a sinking feeling when I think of trying to use the online course system.
Anx6*	I feel comfortable working with the online course system.
Anx7	The online course system makes me feel uneasy.
Anx8	It scares me to think that I could lose a lot of information using the online course system by hitting the wrong key.
Anx9	I hesitate to use the online course system for fear of making mistakes I cannot correct.
Anx10	The online course system is somewhat intimidating for me.
Persistence	
Per1	I am very determined to finish this online course.
Per2	I often think of dropping this online course.
Per3*	I often wonder if the studies are worth it.
Per4	I am undecided about completing this online course.
Per5	I am about to drop out from this course online.
Per6	I have already dropped out from this course online.
Per7*	I intend to register for this online course in which I am currently enrolled in the next term or next year.

Note: * these items were removed for the analyses

values are satisfactory (Crocker and Algina 1986) and comparable to those reported in previous studies.

A factor score for each construct was computed and used in all the statistical analyses in the study. The means and standard deviations of the scores on each of the constructs according to gender, age and prior online course experience groups are presented in Table 3. In order to ensure the relevance of using gender, age and previous prior online course experience as moderating variables, *t*-test analyses were conducted on these groups. The results are presented in Table 3. These analyses revealed significant differences between men and women on the following variables: performance expectancy ($t = 2.06$, $p < 0.05$), social influence ($t = 1.97$, $p < 0.05$), attitude ($t = 2.18$, $p < 0.05$) and persistence ($t = 2.57$, $p < 0.05$), with men always having lower scores, on average, than women. These analyses also revealed significant differences between age groups on effort expectancy ($t = 3.00$, $p < 0.01$) and social influence ($t = 3.73$, $p < 0.01$), with younger students having lower scores, on average, on these variables. Finally, these analyses were conducted on prior online course experience groups. They revealed that students who had 4 or more online courses scored lower on facilitating conditions than those who had 3 or fewer courses ($t = 2.27$, $p < 0.05$).

Table 3 Means, standard deviations and t-test results for the independent and dependent variables according to gender, age and experience with online courses

		Gender						Age						Prior online course experience					
		Men n = 99		Women n = 331				25 years and younger n = 237		26 years and older n = 183				3 online courses and less n = 201		4 online courses and more n = 229			
	α	M	SD	M	SD	t	p	M	SD	M	SD	t	p	M	SD	M	SD	t	p
Independent variables																			
PE	.95	−.18	1.15	.05	.95	2.06	.040*	.02	.95	−.02	1.06	.39	.694	−.02	.94	.02	1.05	.43	.668
EE	.89	−.06	1.04	.02	.99	.66	.509	.13	.85	−.16	1.14	3.00	.003**	−.05	.94	.04	1.05	.91	.366
SI	.81	−.17	1.02	.05	.99	1.97	.049*	.16	.99	−.20	.98	3.73	.000**	.06	1.00	−.05	1.00	1.13	.259
FC	.80	−.08	1.07	.02	.98	.86	.393	.06	.94	−.08	1.07	1.45	.147	−.12	1.01	.10	.98	2.27	.024*
AUT	.89	−.19	1.13	.06	.95	2.18	.029*	.00	.97	−.01	1.03	.10	.918	−.03	1.03	.02	.97	.55	.584
ANX	.90	.06	1.11	−.02	.97	.64	.522	.01	1.02	−.01	.98	.13	.900	.08	1.11	−.07	.89	1.62	.106
Dependent variable																			
Persistence	.86	−.23	1.30	.07	.88	2.57	.010*	.01	.95	−.02	1.06	.32	.750	−.03	1.06	.02	.95	.52	.604

Notes

1. n = 430
2. α: Cronbach Alpha
3. PE: performance expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, AUT: attitude towards online course system, ANX: anxiety
4. * $p < 0.05$; ** $p < 0.01$

4.2 Hypotheses testing

4.2.1 Hypotheses testing for the whole sample (H_{PE}, H_{EE}, H_{SI}, H_{FC}, H_{AUT}, H_{ANX}).

In order to examine the influence of technological factors on persistence in online courses, correlations and a multiple linear hierarchical regression were conducted on the whole sample. The results of these correlations and this regression are presented respectively in Tables 4 and 5.

According to Table 4, all the technological factors are positively related to persistence in online courses, except for social influence and anxiety, which exhibit negative correlations. The multiple linear hierarchical regression was significant: $F(6,430) = 30.23$, $p < 0.001$. The R^2 coefficients of determination indicate that 29.1% of variance in persistence can be explained by technological factors of the UTAUT model to which attitude towards online course system and anxiety were added. Study hypotheses H_{PE}, H_{EE}, H_{SI}, H_{FC}, H_{ATT} and H_{ANX} are tested at a unilateral significance level of 0.05 because of the direction they were given during formulation of the hypotheses following the literature review. The *t* tests are thus one-tailed and the *p*-values detailed in Table 4 according to these hypotheses are adjusted for unidirectionality (a *p* value smaller than 0.05 represents statistical significance).

According to the analyses presented in Table 5, H_{PE} by which performance expectancy has a positive impact on persistence in online courses is supported ($\beta = 0.19$, $t = 2.98$, $p < 0.01$). Effort expectancy has a positive effect on persistence in online courses ($\beta = 0.15$, $t = 2.86$, $p < 0.01$). H_{EE} is thus supported. Social influence has a significant impact on persistence in online courses, but this impact is negative and contrary to what has been suggested in H_{SI} ($\beta = -0.12$, $t = 2.70$, $p < 0.01$). Thus, H_{SI} must be rejected. Facilitating conditions is not related to persistence in online courses. H_{FC} must be rejected. Positive attitude has a significant negative effect on persistence in online courses ($\beta = -0.16$, $t = 2.17$, $p < 0.05$). This is contrary to what has been suggested in H_{AUT}. Thus, H_{AUT} must be rejected. Finally, H_{ANX} by which anxiety has a negative effect on persistence in online courses is confirmed ($\beta = -0.42$, $t = 9.30$, $p < 0.01$).

Table 4 Correlations between technological factors and persistence in online course for the whole sample

	The whole sample $n = 430$						
	1	2	3	4	5	6	7
1.PE	1						
2.EE	,33**	1					
3.SI	,36**	,11*	1				
4.FC	,56**	,63**	,21**	1			
5.AUT	,76**	,44**	,31**	,68**	1		
6.ANX	-,14**	-,35**	,14**	-,32**	-,21**	1	
7.Persistence	,17**	,32**	-,13**	,27**	,15**	-,50**	1

Notes: PE: performance expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, AUT: attitude towards the use of LMS, ANX: anxiety towards the use of LMS. * $p < 0.05$; ** $p < 0.01$

4.2.2 Hypotheses testing for gender, age and prior online course experience groups (H_{GEND}, H_{AGE}, H_{EXP}).

In order to verify research hypotheses H_{GEND} H_{AGE} and H_{EXP}, and make appropriate gender, age and prior online course experience group comparisons, the sample was initially divided to form two groups: men ($n = 99$) and women ($n = 331$), and then, into two other groups: students aged 25 years and younger ($n = 237$) and students aged 26 years and older ($n = 183$) and finally two prior online course experience groups: students with 3 or fewer online courses ($n = 201$) and students with 4 or more online courses ($n = 229$). Correlations and multiple linear hierarchical regression analyses were run separately for each group. The results for correlations are presented in Table 6.

According to Table 6, all the technological factors are related to persistence in online courses, except for men (correlations between respectively performance expectancy, social influence and persistence are not significant), for students 25 years and younger (correlations between respectively performance expectancy, attitude and persistence are not significant), for students 26 years and older (correlation between social influence and persistence is not significant), and for students with 3 or fewer online courses (correlations between respectively social influence, attitude and persistence are not significant).

As depicted in Table 5, the multiple linear hierarchical regressions were significant: for men $F(6,99) = 7.26$, $p < 0.001$, for women $F(6,331) = 29.11$, $p < 0.001$, for students 25 years old and younger $F(6,237) = 21.54$, $p < 0.001$, for students of 26 years and older $F(6,183) = 13.03$, $p < 0.001$, for students with 3 or fewer online courses $F(6,201) = 29.05$, $p < 0.001$ and for students with 4 or more online courses $F(6,229) = 9.80$, $p < 0.001$. The R^2 coefficients of determination indicate that 27.9% for men, 33.2% for women, 34.4% for students 25 years and younger, 27.3% for students 26 years and older, 45.7% for students with 3 or fewer online courses and 18.9% for students with 4 or more online courses can be explained by technological factors of the UTAUT model to which attitude towards online course system and anxiety were added. The R^2 coefficients of determination were different in all cases from R^2 of the overall model ($R^2 = 29.1\%$).

The models according to gender groups presented different significant relationships as compared to the overall model. Moreover, the women's model revealed different significant relationships than the men's model; research hypothesis H_{GEND} is thus confirmed. The links between performance expectancy and persistence ($\beta = 0.24$, $t = 3.57$, $p < 0.01$) and between attitude and persistence ($\beta = -0.16$, $t = 2.06$, $p < 0.01$) were significant for women and not for men, whereas the relationship between effort expectancy and persistence was significant for men ($\beta = 0.29$, $t = 2.12$, $p < 0.01$) and not for women.

The models according to age groups did reveal different significant relationships than did the overall model. Moreover, the two models per age group presented different patterns of significant relationships; thus, research hypothesis H_{AGE} is confirmed. More precisely, the relationships between performance expectancy ($\beta = 0.31$, $t = 3.24$, $p < 0.01$) and persistence, and effort expectancy and persistence ($\beta = 0.19$, $t = 2.25$, $p < 0.05$), facilitating conditions and persistence ($\beta = 0.21$, $t = 1.95$, $p < 0.05$), and attitude and persistence ($\beta = -0.38$, $t = 3.32$, $p < 0.01$) were significant for students aged 26 years and older, but not for the other age group. Inversely, the links between

Table 5 Multiple hierarchical linear regressions: technological factors predicting persistence in online course for the whole sample, gender, age and prior online course experience groups

	The whole sample n = 430		Gender				Age				Prior online course experience			
			Men n = 99		Women n = 331		25 years and younger n = 237		26 years and older n = 183		3 online courses and less n = 201		4 online courses and more n = 229	
	st. β	*t*	*st. β*	*t*	*st. β*	*t*	*st. β*	*t*	*st. β*	*t*	*st. β*	*t*	*st. β*	*t*
PE	.19	2.98**	.02	.16	.24	3.57**	.04	.46	.31	3.24**	.08	.98	.24	2.61**
EE	.15	2.86**	.29	2.12*	.09	1.59	.10	1.58	.19	2.25*	.02	.34	.26	3.29**
SI	−.12	2.70**	−.17	1.79*	−.13	2.62**	−.17	3.00**	−.05	.72	−.14	2.45**	−.07	1.08
FC	.06	.92	.27	1.65	−.02	.34	−.06	.76	.21	1.95*	−.01	.10	.20	2.03*
AUT	−.16	2.17*	−.17	1.02	−.16	2.06*	.05	.51	−.38	3.32**	.03	.32	−.35	3.25**
ANX	−.42	9.30**	−.26	2.76**	−.52	10.23**	−.52	8.89**	−.33	4.83**	−.61	10.26**	−.20	3.11**
Adj. R²		29.1%		27.9%		33.2%		34.4%		27.3%		45.7%		18.9%
F		30.23**		7.26**		29.11**		21.54**		13.03**		29.05**		9.80**

Notes: PE: performance expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, AUT: attitude towards online course system, ANX: anxiety towards the use of online course system. * $p < 0.05$; ** $p < 0.01$

Table 6 Correlations between technological factors and persistence in online course for gender, age and prior online experience groups

	Men n = 99							Women n = 331						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1.PE	1							1						
2.EE	,48**	1						,27**	1					
3.SI	,35**	,21*	1					,36**	,07	1				
4.FC	,62**	,77**	,35**	1				,54**	,58**	,17**	1			
5.AUT	,81**	,59**	,35**	,70**	1			,73**	,39**	,28**	,68**	1		
6.ANX	-,16	-,27**	,09	-,29**	-,21*	1		-,13*	-,38**	,16**	-,33**	-,21**	1	
7.Persistence	,17	,44**	-,09	,40**	,20*	-,40**	1	,16**	,27**	-,17**	,20**	,11*	-,56**	1
25 years and younger n = 237								26 years and older n = 183						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1.PE	1							1						
2.EE	,28**	1						,38**	1					
3.SI	,34**	,03	1					,39**	,13	1				
4.FC	,51**	,57**	,17*	1				,62**	,67**	,25**	1			
5.AUT	,77**	,34**	,27**	,62**	1			,75**	,54**	,36**	,75**	1		
6.ANX	-,13*	-,35**	,14*	-,31**	-,17**	1		-,15*	-,37**	,15*	-,34**	-,27**	1	
7.Persistence	,08	,27**	-,23**	,18**	,12	-,57**	1	,26**	,36**	-,03	,35**	,19**	-,43**	1
3 online courses and less n = 201								4 online courses and more n = 229						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
1.PE	1							1						

Table 6 (continued)

	Men n = 99							Women n = 331						
	1	2	3	4	5	6	7	1	2	3	4	5	6	7
2.EE	,33**	1						,34**	1					
3.SI	,34**	,09	1					,39**	,13	1				
4.FC	,58**	,62**	,20**	1				,56**	,64**	,25**	1			
5.AUT	,79**	,39**	,30**	,66**	1			,74**	,49**	,32**	,71**	1		
6.ANX	-,18*	-,39**	,22**	-,30**	-,20**	1		-,10	-,31**	,05	-,34**	-,23**	1	
7.Persistence	,17*	,29**	-,24**	,23**	,18*	-,67**	1	,17**	,35**	-,02	,30**	,13	-,30**	1

Notes: PE: performance expectancy, EE: effort expectancy, SI: social influence, FC: facilitating conditions, AUT: attitude towards the use of LMS, ANX: anxiety towards the use of LMS. * $p < 0.05$; ** $p < 0.01$

social influence and persistence ($\beta = -0.17$, $t = 3.00$, $p < 0.01$) was significant for students aged 25 years and younger, but not for students aged 26 years and older.

The models according to prior online course experience groups also revealed different relationships than did the overall model. Moreover, the model according to the group of students with 3 or fewer online courses presented different patterns of significant relationships from the group of students with 4 or more online courses; thus, research hypothesis H_{EXP} is confirmed. The relationships between performance expectancy and persistence ($\beta = 0.24$, $t = 2.61$, $p < 0.01$), effort expectancy and persistence ($\beta = 0.26$, $t = 3.39$, $p < 0.01$), facilitating conditions and persistence ($\beta = 0.20$, $t = 2.03$, $p < 0.05$) and attitude and persistence ($\beta = -0.35$, $t = 3.25$, $p < 0.01$) were significant for students with 4 or more online courses and not for the other group of prior online course experience. Inversely, the link between social influence and persistence was significant for the group of students with 3 or fewer online courses and not for the other group of prior online course experience.

Table 7 presents a synthesis of the results according to each hypothesis tested in this study.

5 Discussion

The aim of this study was to verify if technological factors had an influence on persistence in online courses in higher education. Technological factors were defined using the UTAUT model of Venkatesh et al. (2003), enriched with attitude and anxiety. These two latter factors were added, as they were taken into account in previous studies assessing either the determinants of use of technologies or the effect of use on students' outcomes (Bozionelos 2004; Khechine and Lakhal 2015, 2018; Mcilroy et al. 2007). Moreover, three mediating variables were included in the analyses, namely gender, age and prior online course experience, given that these variables were considered in information system

Table 7 Summary of the study hypotheses confirmed and rejected

Study hypotheses		Results
H_{PE}	Performance expectancy has a positive impact on persistence in online course.	Confirmed.
H_{EE}	Effort expectancy has a positive impact on persistence in online course.	Confirmed.
H_{SI}	Social influence has a positive impact on persistence in online course.	Rejected.
H_{FC}	Facilitating conditions have a positive impact on persistence in online course.	Rejected.
H_{AUT}	Positive attitude towards online course system has a positive impact on persistence in online course.	Rejected.
H_{ANX}	Anxiety has a negative impact on persistence in online course.	Confirmed.
H_{GEND}	There is a difference in the patterns of significant relationships in the two models per gender group.	Confirmed.
H_{AGE}	There is a difference in the patterns of significant relationships in the two models per age group.	Confirmed.
H_{EXP}	There is a difference in the patterns of significant relationships in the two models per prior online course experience group.	Confirmed.

acceptance models (such as UTAUT), in persistence models (Rovai 2003) and in previous studies. Nine research hypotheses were stated and tested. The results of the study are discussed in the following paragraphs.

The results of this study suggest that technological factors borrowed from the UTAUT model, including attitude and anxiety, are able to provide an empirical explanation of students' academic persistence in online courses. Moreover, for the whole sample, anxiety is the most important factor in predicting persistence in online courses, followed by performance expectancy, attitude, effort expectancy and social influence. Students are more likely to persist when they: a) feel less anxious while using the online course system, b) expect that using the online course system will help them improve their academic performance (i.e., be useful, enhance their effectiveness and increase their productivity in their learning activities), c) have a less favorable attitude towards the online course system, d) perceive that using the online course system would be easy for them, and e) perceive that people important to them believe they should not use the online course system. No significant relationship was found between facilitating conditions and persistence in online courses. Thus, study hypotheses H_{PE}, H_{EE}, H_{ANX} are confirmed and H_{SI}, H_{FC} and H_{AUT} must be rejected. The model considered in the present study was also examined according to gender, age and prior online course experience. The findings obtained from dividing the students into groups are interesting. This is one of the key contributions of the present study. The results indicated different patterns of significant relationships between groups according to gender, age and prior online course experience. Thus, H_{GEND}, H_{AGE} and H_{EXP} are confirmed.

As for anxiety, the more anxious a student is, the less he/she is willing to persist in online courses. Anxiety is a significant predictor of persistence for all the groups considered in the study. Moreover, the results of the present study showed that anxiety is the most important predictor of persistence in online courses for the whole sample, for women, for students 25 years and younger, and for students with 3 or fewer online courses. According to Abdous (2019), students' anxiety is due to a variety of factors such as a lack of clear instructions on how to use the online course system, or negative experience with online courses. Moreover, according to this last author, when a student is a woman, younger and has less prior experience with online course systems, he/she tends to be more anxious than a man, an older student or another student with more online course experience. Previous research reported that women are likely to be more anxious than men in online courses. This may be explained by the fact that they are more likely to have multiple responsibilities, such as family and work (Abdous 2019). Moreover, a recent meta-analysis reported that women were more anxious than men when using technologies (Cai et al. 2017). For younger students, the present study showed that the most important predictor of persistence in online courses could be explained by anxiety. This could be due to the fact that "any feelings of anxiety and emotional distress associated with online learning tend to diminish as one grows older" (Abdous 2019, p. 42). As for prior online course experience, for students with 3 or fewer online courses, anxiety is the most important predictor of persistence in online courses. This result is in line with previous studies. According to Hachey et al. (2014), prior online course experience is a strong predictor of persistence and success in online courses, because it is an important predictor of anxiety among online students (Abdous 2019). Students with strong online course experience may exhibit high online learning self-efficacy and self-confidence, which may lower their anxiety. Furthermore, students' level of technological skill should be assessed at the beginning of online courses, in order to help those who do not

possess adequate capabilities and to be able to lower the level of anxiety, especially for women, younger students and inexperienced ones. Ideally, students' level of technology skill should be similar; otherwise, some students might need to spend additional time improving these skills, which may discourage them unless they have adequate support.

Performance expectancy was shown to be the second most important predictor of persistence in online courses for the whole sample, for women, for older students and for those with 4 or more online courses. The expectancy of performing better in the course encouraged students to use the online course system and to persist in the courses. Thus, the online course system should contain some tools in order to allow students to do self and peer assessment, which are recognized as effective assessment approaches for student learning, in order to enhance their academic performance (Adachi et al. 2018a, b). Moreover, self-regulated learning strategies should be encouraged by instructors in these courses and included in the system, such as time management, metacognition, effort regulation, and critical thinking, as these strategies are found to correlate with academic achievement, according to a recent systematic review (Broadbent and Poon 2015).

Attitude towards online course system was the third most important predictor of persistence in online courses for the whole sample. Attitude was also significant in predicting persistence in online courses for women, older students and more experienced students. The more the student had a negative attitude, the more he/she was willing to persist in online courses. This negative relationship is somewhat surprising and contrary to what has been hypothesized. This could be explained by the fact that other variables are included in the analyses: performance expectancy, effort expectancy, social influence, facilitating conditions and anxiety. Without considering these variables, the relationship between attitude and persistence in online courses is positive (see correlations in Table 4 and in Table 6).

As for effort expectancy, the more the student perceives that using the online course system will be easy, the more he/she is willing to persist in online courses. This factor was the fourth most important predictor of persistence in online courses for the whole sample. It was also significant in predicting persistence in online courses for men, older students and the more experienced ones, but not for the other groups considered in the study. This result could be explained by the fact that the online course system used in the university where the study was conducted is not a commercial platform but was created by the higher education institution itself. Some functionalities are not up-to-date and some students' needs may not yet have been responded to. These needs must be expressed by a certain number of users and prioritized in order to be addressed and met. For these reasons, students may perceive that the online course system is not easy to use.

Social influence has a negative effect on students' persistence in online courses for the whole sample, for men and women, for younger students and less experienced ones. The less students perceive that people important to them believe they should use an online course system, the more they are willing to persist in online courses. Moreover, for students 25 years and younger and for those with 3 or fewer online courses, this technological factor is the second most important one in predicting persistence in online courses. For these two groups of students, their colleagues are probably more willing to enroll in face-to-face courses because they may be full-time students or may be inexperienced with online courses. These colleagues may have negative opinions on online course system used at the university where the study took place and more broadly on online courses. The students in the current study who responded to the

online questionnaire were enrolled in online courses, despite their colleagues' opinions, and intend to persist, probably because they want to benefit from the advantages of this course delivery mode, such as flexibility and accessibility (Cidral et al. 2018) or their study habits and their learning styles fit better with these courses.

Finally, facilitating conditions failed to be a significant predictor for persistence in online courses for the whole sample. However, facilitating conditions explained persistence for older students and the more experienced ones. For these two groups of students, the more the student believes that an organizational and technical structure exists to support the use of the online course system, the more they are willing to persist in online courses. Thus, technical problems encountered should be resolved rapidly; otherwise, they may interfere with student learning (Wang and Hsu 2008), and thus, with the likelihood of persisting in online courses.

6 Conclusion

This study aimed to explore the technological factors that explain persistence in online courses. Based on the UTAUT model, this study tested a theoretical model encompassing six explanatory variables: performance expectancy, effort expectancy, social influence, facilitating conditions, attitude and anxiety. The empirical results indicated that the main drivers of persistence in online courses were, in order of importance, anxiety, performance expectancy, attitude, effort expectancy and social influence. The model was further tested according to gender, age and prior online course experience groups. The results suggested that these latter variables played a moderating role. Depending on the subgroup considered, some technological factors have an effect on persistence. Knowledge of this finding is important for instructors. In order to foster student persistence and success in online courses, they could use some compensatory strategies that are better adapted to their students (e.g., offering additional training for those who lack technological skills). It would also be justified for higher education institutions to diversify these strategies in order to give all students a fair chance of persistence success (e.g., by giving just-in-time answers for those who need assistance). This study was conducted among a voluntary sample of students. This raises the question of the existence of differences between those who answered and those who did not answer the online questionnaire. Therefore, the results of this study must be generalized with care. This study should be replicated on larger randomly selected samples of students enrolled in online courses.

From a theoretical standpoint, the results of the present study add support to the scholarly literature on persistence in online courses by validating a model encompassing technological factors borrowed from the UTAUT model to which attitude and anxiety were added. From a practical perspective, this study offers several avenues of reflection for both administrators and faculty members. This research could help them clarify their vision and improve their actions and decisions regarding the implementation of online courses, by informing them about the most influential factors in students' persistence in these courses.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.
Research involving human participants and/or animals: this research involved human participants.

Informed consent Informed consent was obtained from participants before data collection.

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