

A Predictive Model to Explain Student Persistence in Blended and Online Courses in Higher Education

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Abstract

This study sought to identify the significant predictors of students' persistence in blended and online courses in higher education. Drawing from Choi's model (2016), a structural model, comprising eight predictive and three moderating variables, was tested. The sample was composed of 348 students enrolled at two French-speaking Canadian universities who completed an online questionnaire. Data were analyzed using partial least squares structural equation modelling (PLS-SEM) and partial least squares multigroup analysis (PLS-MGA). The findings suggest that learner autonomy, student satisfaction, perception of a Community of Inquiry, and family responsibilities are the primary factors influencing student persistence in blended and online courses. Furthermore, the model explains between 9.3% and 46.4% of the variance in persistence, depending on whether we examine the moderating effect of age, gender or course modality. The paper presents recommendations for institutions and faculty seeking to enhance student persistence in blended or online courses.

Keywords: Higher education, online courses, blended courses, student persistence factors

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Distance education has evolved with technological developments in communications (Lee, 2017; Moore, 2018a). The most recent generation of distance education—the one mediated by Web technologies—has enabled higher education institutions to offer new course modalities to their students (Lakhal & Bélisle, 2020). If we consider the proportion of content delivered online, as proposed by Allen et al. (2016), in addition to traditional face-to-face courses where no or little online technology is used (0% to 29% of content delivered online), two types of courses are now available to students in higher education: blended or hybrid (courses with a combination of face-to-face and online modalities where a substantial proportion [30 to 79%] of the content is delivered online), and online (courses where 80% of the content is delivered online). These two modalities are on the rise as indicated by the number of students enrolled in these courses. For example, in Canada, many post-secondary students had experienced at least one fully online course (40%) or at least one blended (36%) in 2024 (Johnson, 2024). This is a marked increase compared to the 17% of students who were enrolled in at least one credited blended or online course (BOC) in a Canadian post-secondary institution during the 2016-2017 academic year (Bates et al., 2019). A similar phenomenon is observable in the United States, where 31.6% of higher education students in 2016 were enrolled in at least one BOC (Seaman et al., 2018). This proportion has increased to 54% by 2022 (National Center for Education Statistics, 2023).

Despite the growing popularity of BOC, it is imperative to acknowledge the challenges associated with these modalities. A recurring issue that has been identified is the lack of student persistence (Delnoij et al., 2020; Heilporn & Lakhal, 2022; James et al., 2016; Shaikh & Asif, 2022; Xavier & Meneses, 2020), especially in online courses. Notwithstanding the heterogeneity of definitions and calculation methods employed, persistence rates observed are often lower in BOC than in face-to-face courses (Fan et al., 2024; Papi et al., 2022; Park & Choi, 2009). Studies which have sought to compare student persistence rates between BOC and face-to-face courses reported a discrepancy in favor of the latter (Ali & Smith, 2015; Garratt-Reed et al., 2016; James et al., 2016; Mohammadian et al., 2021; Wladis et al., 2017; Xu & Jaggars, 2011).

Literature Review

Several scholars have examined the factors associated with persistence in BOC within the context of post-secondary education. According to several literature reviews published in the last two decades (Bawa, 2016; Hart, 2012; Lee & Choi, 2011; Paris, 2024; Shaikh & Asif, 2022; Xavier & Meneses, 2020), a variety of factors have been identified as both facilitators and barriers to student persistence in higher education BOC. Consequently, persistence can be regarded as a multifaceted phenomenon, influenced by a range of factors contributing to student persistence or non-persistence (i.e., dropout). To enhance comprehension of the factors that contribute to students' persistence in their respective courses or programs, and to facilitate understanding of this intricate phenomenon, a number of theoretical models have been developed. These models identify the major factors that influence persistence and illustrate the dynamic aspects of the phenomenon (Xavier & Meneses, 2020).

In 1989, Kember proposed the *Longitudinal Model of Individual Departure*, a longitudinal model designed to explain the persistence of students enrolled in distance education. The author posits that the student population enrolled in distance education is non-traditional, i.e. generally older and usually studying part-time. The model identifies four categories of variables that explain the decision to persist or dropout: the characteristics of the student population, goal

commitment, the academic and social environment, and finally, the evaluation of costs and benefits. In 2003, Rovai proposed a *Composite Persistence Model* with the aim of explaining the persistence of the non-traditional student population, specifically in the context of online learning. This model incorporates two models of dropout in higher education, namely those of Tinto (1993) and Bean and Metzner (1985). Rovai's model comprises four components, two of which are present prior to admission (student characteristics and student skills) and two after admission (internal and external factors). The decision to persist is determined by the internal factors, and indirectly by the other three components of the model. According to Rovai (2003), persistence in online learning involves a considerable number of interactions between the many factors.

In 2007, Park proposed an update to Rovai's model, which evolved into the *Revised Model of Dropouts from Distance Learning in Organizations* (Park & Choi, 2009). This model was designed for non-degree online programs for adults learners. According to Park and Choi (2009), a review of the extant literature revealed that the Rovai (2003) model requires some adjustments. Park's model retains the categories of the Rovai model; however, due to a lack of empirical evidence, certain variables intrinsic to these components are extracted from the model and the structure and relationships between the components of the model are significantly reorganized. Finally, in 2016, Choi modified their previous model and proposed a *Framework for Adult Dropouts in a Cyber University*. The most significant modifications consist of the integration of student skills with learner factors (rather than student characteristics), as well as the incorporation of academic performance within the program, which has been demonstrated to exert a direct influence on student persistence. This model focuses on factors affecting higher education, non-traditional adult learners' decisions to persist in online formal (i.e. credited) degree programs.

Several conclusions may be deduced from these models. First, the focus of all models is on non-traditional students. According to Rovai (2003), these students are typically defined as individuals over the age of 24 who often have family and professional responsibilities and are enrolled on a part-time basis. It can be argued that the student populations in BOC are diverse and do not exclusively consist of non-traditional students. As previously stated, a significant number of universities and colleges have adopted these modalities within their respective programs. Then, despite the preponderance of non-traditional students within numerous BOC or programs across various institutions, the traditional student demographic remains significant in many BOC. It is also important to consider their characteristics. Second, as argued by Choi and Kim (2018), conceptualizing the important factors in the decision to persist remains an ongoing process until scholars reach a consensus based on more empirical evidence. Only a limited number of studies have empirically tested the overall viability of these above-mentioned models (Rawal & Razak, 2022). Further research is therefore needed to validate the effectiveness and efficacy of these models. Third, as noted above, persistence is the result of a multifaceted process involving many factors and complex interactions. In this regard, some of the models indicate that a factor may not have a direct effect on persistence but may significantly influence another factor that does have a direct and significant effect. Also, according to the literature review mentioned above, some variables have a mediating or a moderating effect in relation to persistence. However, most studies do not measure indirect effects, the effects of several factors at the same time, or mediating and moderating effects, often for methodological reasons. To develop a deeper understanding of persistence in BOC, it is necessary to examine various relationships

between multiple variables. Therefore, it seems important to consider the factors for all kinds of students (traditional and non-traditional), the different characteristics proposed by the models, and also the possible relation between the categories of characteristics.

The study's objective is to provide a student persistence model in BOC that draws upon the one proposed by Choi (2016). This model was selected since it has been developed by building on the empirical results of all the other models (Rawal & Razak, 2022), and because it was designed for formal education, which is the case in this study. To the best of our knowledge, only a small number of studies (Choi & Kim, 2018; Choi & Park, 2018; Choi, 2021) have validated this model in order to identify factors associated with student persistence within online courses in formal higher education, and all of these studies were conducted by the model developer. Furthermore, there have been no studies published involving blended courses. Accordingly, to furthering knowledge, this study will validate a predictive model of student persistence in the context of BOC in higher education by answering the following question:

Which factors are significant predictors of students' persistence in BOC in higher education?

Research Model

According to Choi (2016), four categories of factors explain student persistence. First, these include learner factors, comprising sociodemographic characteristics, basic scholastic aptitude, and studying motive. Second, external factors, defined as aspects that occur outside the classroom are included, such as variables deemed to be environmental like financial situation, employment status, or family responsibilities. Third, internal factors encompass characteristics associated with the studies and are related to the educational institution, faculty, and courses, such as the course's pedagogical design or institutional support. The final factor is Grade Point Average (GPA), indicating scores in courses on average, as an outcome factor. As illustrated in Figure 1, the research model incorporates factors from each of these categories. Furthermore, the selection of factors within each category was informed by (a) the findings from the most recent literature review (Bawa, 2016; Hart, 2012; Lee & Choi, 2011; Paris, 2024; Shaikh & Asif, 2022; Xavier & Meneses, 2020); (b) the results of studies concerning the selected factors; and (c) the need to address gaps observed in previous studies (e.g. limited focus on blended courses, lack of moderator testing, and inconsistent results for some factors across studies).

Persistence

As indicated by Roland et al. (2015), there are many definitions and operationalizations of persistence and these may refer to various forms of behavior depending on the perspective adopted. In this study, persistence in BOC is examined from the student's perspective, which relates to the student's decision to continue studying (Kharchi, 2021). In this regard, persistence is operationalized as "the intention to complete the online course in which the student is enrolled" (Lakhali et al., 2021, p. 4).

Learner Factors

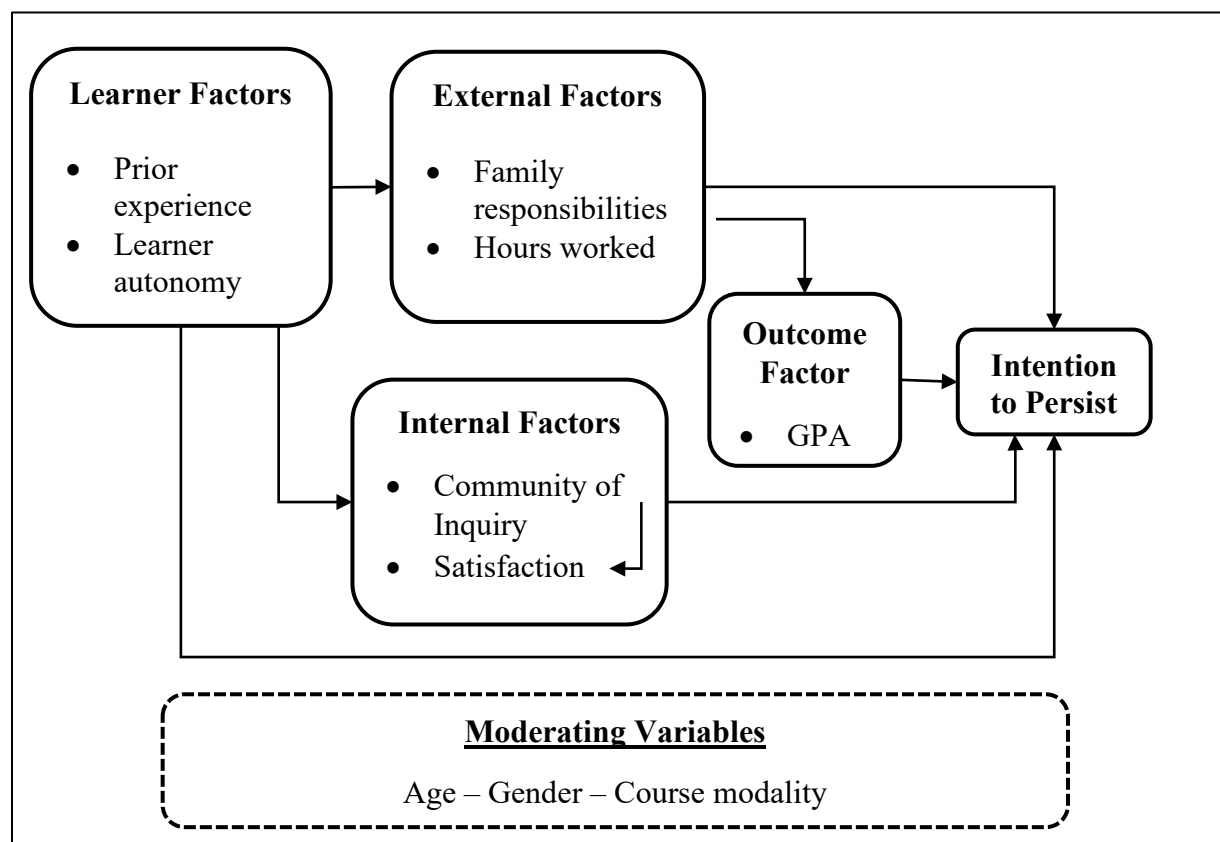
The relation between learner factors and persistence is not likely to be direct (Kember, 1989). All previously presented models demonstrate an indirect relationship between the learner factors and persistence. According to Choi (2016), the learner factors exert an indirect influence on persistence, with this influence being exerted through both internal and external factors.

Nonetheless, basic scholastic aptitude and studying motivation can be regarded as significant predictive variables for the successful completion of BOC (Choi & Kim, 2018). Consequently, it is posited that the integration of these two factors in learner characteristics should result in the addition of a direct link between learner factors and persistence.

Accordingly, this study will first examine the effect of *prior experience* on persistence and internal factors. Prior experience, defined as the number of courses previously taken, impacts persistence in online courses (Lee & Choi, 2011; Shaikh & Asif, 2022). It remains unclear whether this is the case for blended courses, as no studies, to our knowledge, have been conducted to investigate this relationship. Studies also demonstrated that previous experience with BOC is positively related to learning satisfaction (Landrum, 2020; Wang et al., 2013; Zhu, 2017) and Community of Inquiry (CoI) presences (Dempsey & Zhang, 2019; Salloum, 2011). The validity of these associations is expected to be confirmed in the present study.

Figure 1

Research Model



Secondly, this study will examine the effect of *learner autonomy* on persistence, and on internal and external factors. According to Andrade and Bunker (2009), learner autonomy is characterized by a variety of learner interventions in their own learning processes such as the establishment of learning objectives, the development of learning plans, the selection of

educational materials and activities, the identification of resources to support learning, the management of time for learning, and the self-assessment of the learning process. As indicated in literature reviews (Hart, 2012; Lee & Choi, 2011; Xavier & Meneses, 2020), students who possess autonomy-related attributes demonstrate higher persistence, suggesting a potential relationship between learner autonomy and persistence in BOC. Research has also demonstrated a positive association between learner autonomy and CoI (Jin et al., 2023; Özüdoğru, 2021; Turk et al., 2022), as well as with student satisfaction (Abuhassna, 2020; Chen et al., 2010; Ke & Kwak, 2013).

External Factors

External factors have the potential to exert an influence on internal factors, GPA, or persistence according to consulted models. An important external factor associated with persistence is personal commitment, such as the number of *hours worked* and *family responsibilities* (Bawa, 2016; Hart, 2012; Lee & Choi, 2011; Paris, 2024; Shaikh & Asif, 2022; Xavier & Meneses, 2020). Balancing studies with other commitments such as full-time work and having family obligations increases the risk of dropout (Papi et al., 2022). However, as indicated by the findings of various studies (Kim & Park, 2015; Papi et al., 2022; Park & Choi, 2009; York, 2014), the presence of familial support is more likely to account for the phenomenon of persistence than being married or having children. This suggests that students perceiving fewer family responsibilities demonstrate greater persistence.

Regarding the influence of employment status on persistence, Sultan & Hagger (2013) results showed that being employed was a barrier to persistence, while Lee & Choi (2011) indicated that it is full-time work that affects persistence. These findings suggest a negative relationship between hours worked and student persistence.

Finally, despite the existence of a direct link between external factors and GPA, as shown by Choi's model, the underlying mechanisms through which these external factors influence academic performance remain to be fully elucidated. While it can be hypothesized that a difficult conciliation between studies and other commitments such as employment or familial responsibilities may potentially have adverse consequences on academic performance, further validation of this association is required.

Internal Factors

Just like external factors, internal factors have a direct effect on persistence (Rovai, 2003; Park, 2007; Choi, 2016). *Student satisfaction* involves diverse aspects of BOC and it may be understood as a multidimensional construct. In this study, we examine satisfaction in terms of four components as proposed by Bolliger and Wasilik (2012): (a) the teacher, (b) the technology (c), the course structure, and (d) overall satisfaction. Besides being viewed as a key measure of learning outcomes in online courses (Lewis, 2019; Wei & Chou, 2020), student satisfaction has been repeatedly identified as a strong, direct, significant and positive factor for persistence in online courses in consulted literature reviews. Moreover, recent studies have confirmed this relationship (Armstrong et al., 2021; Choi & Kim, 2018; Choi & Park, 2018; Lakhal et al., 2021; Paris et al., 2025). It's not clear whether the effect is similar in blended, but we assume it is.

Course design and interaction are also mentioned as internal factors influencing persistence (Xavier & Meneses, 2020). The *CoI* framework is a particular learning environment

based on the principles of the social constructivist paradigm of learning and the three presences of the model correspond to various types of interaction according to Saadatmand et al. (2017). As mentioned in previous research (Paris et al., 2025), studies that examine the relationship between CoI and persistence reported a positive effect of one or more presences on persistence, but this effect is most often indirect, especially when the relationship is mediated by student satisfaction. Accordingly, although Choi's models do not illustrate the potential links between variables in the same category, we will examine this relationship.

Academic Performance

Academic performance, most often measured by GPA, has been identified as an outcome factor affecting directly persistence, as posited by Choi (2016). According to Choi and Kim (2018), this addition was necessitated by empirical evidence from numerous studies demonstrating that GPA is a salient predictor of students' decisions to persist or drop out in distance education programs in higher education. Literature reviews have on many occasions highlighted that learners with lower academic results are more prone to drop out from online classes (Hart, 2012; Lee et al., 2011; Shaikh & Asif, 2022; Xavier & Meneses, 2020). Accordingly, the research model will examine the extent to which GPA has a direct influence on persistence.

Moderating Variables

Several researchers have directed their attention toward an examination of the disparities in *age* and *gender* with respect to persistence (Shaikh & Asif, 2022). There is no clear consensus in the existing literature on the impact of such factors: Some report that learner characteristics have a significant impact on the decision, while others claim that these characteristics have only a small or indirect impact, or no impact at all (Papi et al., 2022; Park & Choi, 2009). Methodology employed can also have an impact on the results obtained, given that indirect effects are not always quantifiable. As demonstrated by Paris et al. (2025), we posit an indirect effect of age and gender on student persistence and, more specifically, a moderating effect.

The research results of James et al. (2016) suggest that blended courses are associated with higher retention rates than online courses. Since few studies have addressed this issue, more research is needed to evaluate this effect. In this research, course modalities is a dichotomous variable (blended versus online). Therefore, we will look at the moderating effect of course modalities on the research model.

Method

Participants

Data collection was conducted during the summer and fall 2023 semesters in two French-speaking Canadian universities. An online questionnaire was developed; all students enrolled in a BOC during the aforementioned semesters were invited by email to complete it. The online questionnaire was available for a period of five weeks and took approximately 15 minutes to complete. The participants were permitted to complete the questionnaire in one setting or return to it as many times as necessary, and they received reminder messages during the data collection period. At the end of the data collection period, five \$50 gift cards were drawn at random among the 348 participants who completed the questionnaire. Descriptive statistics of the sample are shown in Table 1.

Table 1*Participant's Profile*

Characteristics	Frequency	Percent
Age		
24 or less	149	42.8
25 or more	199	57.2
Gender		
Women	275	79.0
Men	67	19.3
Course modalities		
Blended	86	24.7
Online	262	75.3

Measures

Most of the data collected derives from simple questions on demographic information (age, gender), the number of courses previously undertaken (prior experience), number of hours worked by week, the current self-reported program's GPA, and the course modality (online or blended). For family responsibilities, participants were invited to provide a response to the following question: *How do you view your family responsibilities?* The response options ranged from 1 (*Not Important*) to 5 (*Very Important*). In addition, we used four existing scales, for which validity and reliability had been established in a previous study. Each one was on a 7-point Likert scale (ranged from 1 [*Strongly Disagree*] to 7 [*Strongly Agree*]). The Learner Autonomy questionnaire, comprised of six items, was taken from Lakhal et al. (2013). Items addressing the CoI presences were taken from a French version (Heilporn & Lakhal, 2020) of the CoI questionnaire developed by Arbaugh et al. (2008). Student satisfaction was measured by twelve items taken from Paris et al. (2025) and the instrument designed to measure students' intentions to persist in their studies was developed by Heilporn and Lakhal (2022) based on the work of Kember (1995) and Lakhal (2019).

Data Diagnostics

The descriptive statistics from the study variables revealed no instances of outliers or extreme values. However, certain indicators (three items for learner autonomy, three items for persistence, and one for CoI) were found to be non-normally distributed, as indicated by skewness and kurtosis values, and upon visual inspection of the P-P plot. The study also encountered one missing data (0.3%) related to intent to persist and six (1.8%) related to gender.

Analytic Strategy

We examined the model (Figure 1) using partial least squares structural equation modelling (PLS-SEM) with SmartPLS® 4 software (Ringle et al., 2024). Moderating effects were assessed using a partial least squares multigroup analysis (PLS-MGA) using the bootstrap method (Hair et al., 2024).

PLS-SEM was deemed to be suitable for this study given its exploratory nature, which involves several latent variables to be explained simultaneously, with some indicators exhibiting non-normal distribution (Chin & Newsted, 1999; Hair et al., 2022). It is also appropriate to test some study hypothesis because PLS-SEM allows detecting mediating and moderating effect in parameter estimates (Cheah et al., 2020). In the present study, we used 5,000 random subsamples and implemented a one-sided significance test at the 0.05 level. The significance of the path coefficient estimates was determined by a bias-corrected and accelerated (BCa) bootstrap interval. Also, *mean value replacement* was used to handle missing data.

Results

We adopted the proposed assessment techniques specifically tailored to PLS-SEM's prediction-oriented nature to evaluate the models, given the theoretical limitations of model and exact fit testing in PLS-SEM (Hair et al., 2019, 2020; Sarstedt & Cheah, 2019). We also followed the guidelines provided by Hair et al. (2024) for the subsequent PLS-MGA analysis.

Measurement Model Assessment of Latent Variables

The analysis of the measurement model was conducted by assessing the item loadings and their significance (loadings $\geq .70$ and significant two-tailed test at the 5% level), the internal consistency reliability (Cronbach α and composite reliability $> .70$), and the convergent (average variance extracted $> .50$) and discriminant (heterotrait-monotrait ratio of correlations $< .90$) validity of each construct (Hair et al., 2020).

The preliminary analysis indicated that all item loadings were significant, but eight items were below the threshold (0.70) (one for learner autonomy, six for CoI, and one for intent to persist). Furthermore, three items related to the CoI scale were below 0.50. These three items were removed, along with those related to learner autonomy and persistence. Removal of other indicators did not result in a relevant increase in internal consistency reliability or convergent validity of the construct. Model was re-estimated, and Table 2 demonstrates that all constructs achieved satisfactory values for other measurement model assessment.

Table 2

Internal Consistency Reliability, Convergent and Discriminant Validity for Latent Variables

	α	CR	AVE	1	2	3	4
1. Learner autonomy	0.89	0.92	0.70	1			
2. CoI	0.97	0.97	0.52	0.24	1		
3. Satisfaction	0.96	0.97	0.70	0.27	0.87	1	
4. Persistence	0.86	0.90	0.70	0.38	0.37	0.45	1

Note. (α) Cronbach alpha, (CR) Composite reliability, (AVE) Average variance extracted, (CoI) Community of Inquiry.

The HTMT ratio values for pairs of constructs are presented in columns 1 to 4, with all confidence intervals' upper bounds being smaller than 0.90.

Structural Model Analysis

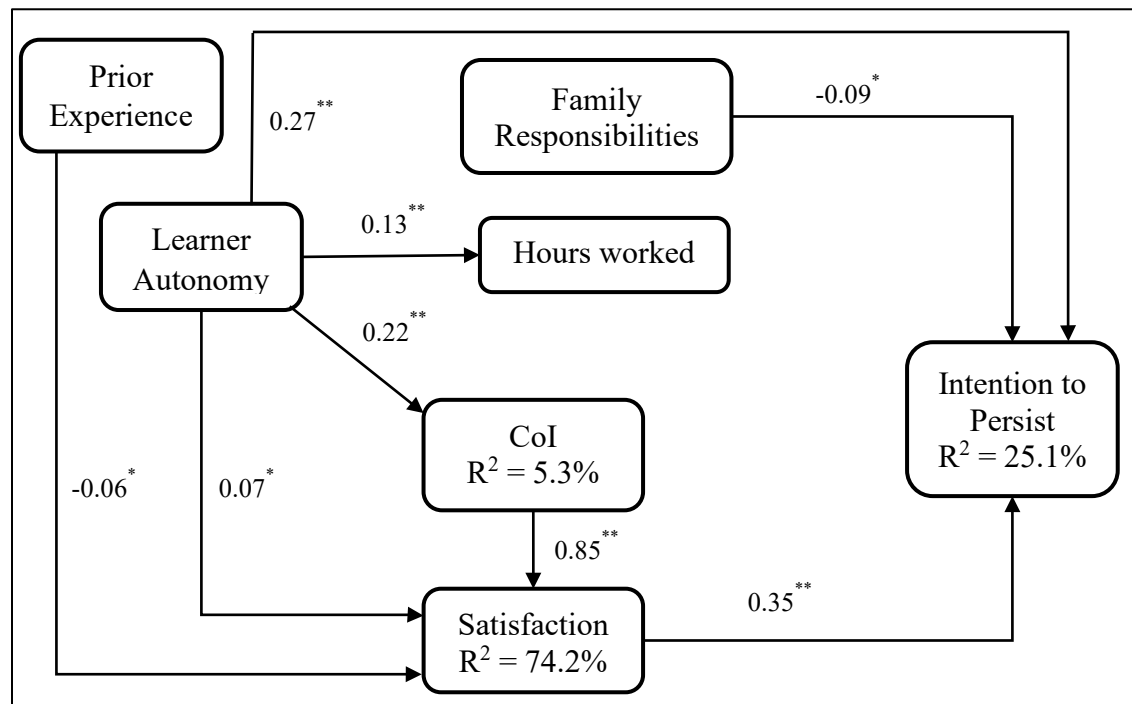
The structural model was assessed by the path coefficients significance and the variance of the endogenous construct. Values for the significant endogenous construct (R^2) and significant path coefficients are indicated in Figure 2 (all values are presented in Appendix B). As shown by the R^2 values, the predictive student persistence model explained 25.1% of the variation in persistence in BOC, 74.2% of student satisfaction, and 5.3% of CoI.

Regarding learner factors, the effect of prior experience on students' satisfaction ($\beta = -0.06, p < .05$) was found to be significant. However, prior experience did not emerge as a predictive factor of CoI ($\beta = 0.05, p = .156$) or persistence ($\beta = -0.01, p = .417$). Concerning the second learner factor, the effect of learner autonomy on family responsibilities was non-significant ($\beta = 0.02, p = .313$), whereas the effect on hours worked ($\beta = 0.13, p < .01$), CoI ($\beta = 0.22, p < .01$), student satisfaction ($\beta = 0.07, p < .05$), and persistence ($\beta = 0.27, p < .01$) were all significant and positive.

The analysis yielded a significant result concerning external factors: the perception of the magnitude of family responsibilities negatively predicts the intention to persist in BOC ($\beta = -0.09, p < .05$). However, the relationships between family responsibilities and GPA ($\beta = -0.03, p = .315$), hours worked and GPA ($\beta = -0.04, p = .209$), as well as hours worked and persistence ($\beta = -0.07, p = .068$), were non-significant.

Figure 2

Structural Model Significant Results for All Respondents



Note. 1. * $p < .05$, ** $p < .01$. 2. CoI (Community of Inquiry).

The research model considered the effects of internal factors on student intent to persist. In regard to the effect of student satisfaction, the relationship was found to be significant ($\beta = 0.35, p < .01$) whereas the effect of CoI was not ($\beta = -0.02, p = .437$). The model also revealed a significant impact of CoI on satisfaction ($\beta = 0.85, p < .01$).

With respect to the effect of academic performance, measured by GPA, it was not a significant predictor of student intent to persist in BOC ($\beta = -0.04, p = .182$).

Finally, Table 3 displays the total effects of all factors on persistence. In addition to the three previously mentioned factors with a significant direct effect on intent to persist, COI has also a significant total effect ($\beta = 0.30, p < .01$). This suggests an indirect effect of CoI on intention to persist when mediated by satisfaction.

Table 3

Total Effect of All Variables on Persistence

Variables	Total effect (β)	<i>p value</i>
Prior experience	-0.00	0.426
Learner autonomy	0.35	< .01
Family responsibilities	-0.09	< .05
Hours worked	-0.07	0.069
Community of Inquiry	0.30	< .01
Satisfaction	0.35	< .01
GPA	-0.04	0.176

PLS-MGA Results

PLS-MGA (bootstrap method) was utilized to assess the moderating effect of age, gender, and course modality. Prior to the analysis, the measurement invariance of composites (MICOM) procedure (Hair et al., 2024) was applied to assess measurement invariance when conducting PLS-MGA. All model results met the criteria to assume partial measurement invariance. We therefore proceeded to compare the variance of intention to persist between groups and the total effects of each factor by groups when this difference was deemed significant. The results of the assessment of the differences across the specified groups are displayed in Table 4 and 5.

Regarding age, PLS-MGA revealed no statistically significant difference in intention to persist between students aged 24 and under and those aged 25 and over ($R^2 \text{ diff} = 0.04, p \text{ diff} = .37$). However, the findings indicated discrepancies with the two other moderating variables observed.

First, the results demonstrated a statistically significant difference in the intention to persist between women and men ($R^2 \text{ diff} = -0.21, p \text{ diff} < .01$). The total effects that differed

statistically are hours worked (β diff = 0.19, p diff < .05), and family responsibilities (β diff = -0.22, p diff < .05).

Table 4

Difference Between Groups in Relation to Persistence

Characteristics	Intent to persist R^2	Difference	p diff
Age			
24 or less	0.295	0.039	.370
25 or more	0.256		
Gender			
Women	0.233	-0.213	< .01
Men	0.464		
Course modalities			
Blended	0.093	-0.221	< .05
Online	0.314		

Table 5

Significant Total Effect Difference by Group in Relation to Persistence

Characteristics and factors	Total effect (β) (Women, Blended)	Total effect (β) (Men, Online)	Difference
<u>Gender</u>			
Hours worked	-0.044	-0.238*	0.194*
Family responsibilities	-0.116**	0.104	-0.220*
<u>Course modalities</u>			
Family responsibilities	0.077	-0.125**	0.202*
Satisfaction	0.149*	0.411**	-0.262*

Note. * $p < .05$, ** $p < .01$

For course modalities (blended versus online), a significant difference was found in the intention to persist (R^2 diff = -0.22, p diff < .05). The PLS-MGA results revealed two factors that differed statistically across this group, namely, the total effect of family responsibilities (β diff = 0.20, p diff < .05) and satisfaction (β diff = -0.26, p diff < .05) on intent to persist.

Discussion and Conclusion

The objective of this study was to develop a predictive model to examine student persistence in BOC in the context of higher education. Drawing from Choi's model (2016), one

of the most recent persistence models in higher education for non-traditional online learners, the study sought to identify the direct and indirect relationships with persistence among significant BOC factors derived from recent literature reviews. These factors were prior experience, learner autonomy, family responsibilities, hours worked, CoI, student satisfaction, GPA, age, gender, and course modality. In addition to identifying key persistence factors among BOC students, our results allowed for the detection of certain moderating effects that are the result of specific characteristics. Furthermore, the study's findings enable the proposal of some modifications to Choi's conceptual model.

Factors Affecting Student Persistence

The findings of this study, when considering all respondents, indicated that three factors (i.e., learner autonomy, family responsibilities and satisfaction) within the proposed model exerted a direct influence on student persistence. Therefore, these three factors were the main contributors to persistence, to which we must add the effect of the CoI for its overall significant contribution. Together, these factors predicted 25.1% of the intention to persist.

Consistent with our findings, student satisfaction with BOC has been repeatedly identified in literature review (e.g., Lee & Choi, 2011; Xavier & Meneses, 2020), models (e.g., Rovai, 2003; Choi, 2016), and studies (e.g., Lakhali et al., 2021; Papi et al., 2022) as significantly and positively influencing persistence. This result implies that institutions offering BOC should implement measures to manage student satisfaction to minimize dropouts. In attempting to do so, instructors and administrators need to consider diverse aspects of BOC because satisfaction is a multidimensional construct (Bolliger & Wasilik, 2012). In this study, satisfaction was examined in relation to teacher, technology, course structure, and overall satisfaction, suggesting that all these aspects should be regarded as important.

The findings also corroborate the notion that learner autonomy is a key characteristic for successful learning for students following a BOC in higher education (Andrade & Bunker, 2009; Fotiadou et al., 2017; Ludwig & Tassinari, 2023; Moore, 2018b). This constitutes an innovative contribution, since to our knowledge, no study has examined this relationship with learner autonomy as measured in this study. It is imperative to acknowledge the importance of cultivating learner autonomy within BOC, given its role in fostering students' persistence. Consequently, it is recommended that educational institutions and faculty implement policies and strategies to help develop skills related to learner autonomy among students.

Family responsibilities have an effect on persistence, which is negative ($\beta = -0.09, p < .05$): An increase in the perception of the magnitude of family responsibilities has a negative effect on persistence. This result suggests that BOC completion is jeopardized by balancing multiple responsibilities, such as studying and raising a family. This finding is consistent with previous research (Evans, 2009; Luz et al., 2018; Shah & Cheng, 2019) in which students mentioned family responsibilities as a primary, if not the most important, reason for dropping out from an online course or program. Since Park's model in 2007, a direct line from external factors to attrition has been added precisely because many studies have reported that some external factors were important reasons why students decided to drop out. Family responsibilities can interfere with the time commitment needed to participate in courses or complete assignments. Therefore, on the one hand, institutions need to recognize the negative impact of any barriers to full participation in BOC, such as having family responsibilities, and to assist these students in

managing their academic and family responsibilities. They can, for example, develop programs and specialized support for students with family and parental responsibilities and identify those who can benefit from them at the time of admission. On the other hand, whether it's moral support or sharing responsibilities with another family member, findings also demonstrate the importance of family support in relation to student persistence, as pointed out by Papi et al. (2022). The authors provide the example of sharing responsibilities with another family member that allows students to be somewhat freed from certain domestic activities, enabling them to maintain their focus on academic endeavors, thereby contributing to their persistence in their studies.

Although the establishment of a learning environment such as the CoI does not directly impact persistence, it should nevertheless be regarded as a key factor in consideration of its overall effect ($\beta = 0.30, p < .01$). This effect is almost as large as the effects of satisfaction ($\beta = 0.35, p < 0.01$) and autonomy ($\beta = 0.35, p < 0.01$). This can be explained by the very strong effect ($\beta = 0.85, p < .01$) of CoI on satisfaction, indicating that a large portion of its variance is explained by this pedagogical design. Thus, in line with other studies (Joo et al., 2011, 2013; Paris et al., 2025), it can be concluded that when the perception of CoI is higher, there is greater satisfaction with BOC, and consequently, an increase in persistence in an ongoing course (i.e., CoI positively and significantly influences students' intention to persist in BOC in higher education when the relationship is mediated by satisfaction). Then, the results of the study demonstrate the benefits of CoI-inspired online learning environments in BOC, especially in promoting persistence.

Considering Student Heterogeneity and Course Modality

When the entire sample is considered, several factors of the research model do not have a significant effect on persistence, although these have been previously identified as having an impact in other publications. However, to draw more precise conclusions, the various moderating effects detected must be examined more thoroughly.

First, this study did not find a difference in persistence as a function of age. The variation of persistence explained by the model is similar for the youngest (24 and under) compared to the oldest (25 and over) students. This suggests that the model should hold for traditional and nontraditional students, given that age (being over 24) has been identified "as one of the most common variables in studies of nontraditional students" (Rovai, 2003, p. 2). Still, it remains unclear what makes age significant in some studies and not in others, and the reasons may be multiple. For example, an overrepresentation of a characteristic that strongly affects persistence in one age group may render the results for age significant in certain contexts. It may also be hypothesized that the age-related differences that existed in the past are of lesser importance in today's context.

The results do, however, show a moderating effect of gender and course modality on persistence. Regarding gender, the model's variables explain persistence better for men ($R^2 = 46.4\%$) than for women ($R^2 = 23.3\%$). The results revealed two barriers to persistence that are specific to each group. The increase in hours worked is an obstacle for men, while it's the increase in family responsibilities that has a negative impact on women. The observed differences may be attributed to divergent perceptions of the student role in higher education among men and women. According to Markle (2015), men give themselves greater flexibility in

allocating their time across various roles and do not experience guilt about spending less time with their families. In contrast, women expressed greater apprehension about their capacity to fulfil their student role in the event of having family responsibilities. Besides, the findings of Burke (2019) indicated that female students were more inclined to report having withdrawn from courses due to familial and parenting duties. Then, the gendered nature of these expectations can explain why this factor exerts its influence solely on women. It can be argued that the aforementioned points also apply to men in the context of employment; that is to say, they place greater emphasis on the value of work in comparison to that of education.

In terms of course modality, the model variables explain little of the variance in persistence for students enrolled in blended courses ($R^2 = 9.3\%$), compared to online ($R^2 = 31.4\%$), where the model performs better. The small amount of variance explained for students enrolled in blended courses suggests that the model variables (selected from online models) are generally less applicable in this context compared to online courses, likely attributable to the inclusion of a face-to-face element. Further studies are necessary to ascertain the applicability of the online model in blended learning. In terms of the differences between the two groups, family responsibilities have a significant impact on those taking an online course, but this impact is not significant in the blended group. One potential explanation for these findings is the interaction effects between certain variables and family responsibilities. Further research is necessary to elucidate this discrepancy. Findings also showed that satisfaction with the course has a greater impact on student persistence online than in blended learning. Again, the possibility remains that certain variables exert a different influence on the degree of satisfaction experienced in blended learning compared to online.

Validation of Choi's Model

Overall, this study demonstrates that learner autonomy, satisfaction, and CoI have a positive impact on persistence among all students enrolled in a BOC in higher education. This is also the case for the degree of family responsibilities, where the impact is negative, except for men (the relationship is not significant). Furthermore, when examining the groups, one additional factor emerges as significant contributor to persistence: hours worked among males.

Our results therefore suggest that Choi's model, designed to examine persistence in the context of an online program, can also be used in the context of a course (although we have mentioned concerns about the blended modality) to examine key predictive variables of persistence. As previously mentioned, the model can also be used for traditional students, since our result showed no difference with respect to age. For that matter, Choi included traditional full-time students in an analysis using the same model in an article in 2021. Concerning the validation of the relationships between the categories in the model, the results obtained validate the theorized indirect effect of the learner factors on persistence and the direct effect of internal and external factors (or at least certain factors) on persistence. Regarding academic performance (GPA), the results are more nuanced. The findings of this study did not demonstrate an impact of internal or external factors on this category. Furthermore, the investigation revealed no significant influence of GPA on persistence. This suggests that academic performance, measured by GPA, may not be a significant factor in examining persistence within the context of a single course. However, its relevance may become apparent when considering the broader context of a program of study.

Finally, our results suggest two possible additions to Choi's model. First, the direct and significant effect of learner autonomy on persistence suggests that learner factors can have a direct effect on persistence, and the model should illustrate this relationship by adding an arrow connecting this category to the predicted variable. Secondly, the results indicated the potential relationship between two factors within the same category (e.g., CoI on satisfaction), at least within internal factors. This finding suggests illustrating these interactions on the model (i.e. relationship between factors within internal factors). Alternatively, the effect of CoI on satisfaction could be interpreted as evidence that satisfaction should be regarded as an intermediate outcome, comparable to academic performance, as proposed by Choi (2021). Further investigation is necessary to verify this assumption.

Limitations and Suggestions for Future Research

It is essential to exercise caution when generalizing from the findings of this study. Firstly, the present study was conducted in two French-speaking institutions located in a Canadian region where French is the predominant language. The influence of cultural factors within this homogeneous population is a potential area of concern. Secondly, this study examined student persistence in a short-term context (i.e., in a course). The findings obtained may not be applicable—to the full extent, or at all—in instances of examining persistence in a program of studies. Thirdly, the limited variance explained for blended courses ($R^2 = 9.3\%$) indicates a need for further research to ascertain the applicability of this model in this context. Also, this study tested a limited proportion of the variables in Choi's model, and overlooking the assessment of certain associations within the category. Consequently, to establish a more robust model and provide more empirical evidence to validate Choi's model, it is imperative that other researchers direct their attention to additional variables and examine all the theoretical relations between categories, including the one proposed in this study. Finally, the elimination of three elements from the CoI scale gives rise to concerns regarding the scale's content validity. It is conceivable that the scale may no longer accurately reflect the concept. This is particularly relevant in the present study, as the items in question have all been designed to measure a dimension of PS entitled *affective expression*. Consequently, the CoI scale employed in this study did not accurately reflect all aspects of PS. Further research may be conducted on the conceptualisation of items of PS since this is also advocated by other authors (Dempsey & Zhang, 2019).

Declarations

Ethics Approval

The present study obtained ethical approval (UL-2020-020 and CER-ESS 2019-2308) from the two universities where the data were collected.

Conflict of Interest

The authors have no competing interests to declare that are relevant to the content of this article.

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