American International Journal of Business Management (AIJBM)
ISSN- 2379-106X, www.aijbm.com Volume 9, Issue 05 (May - 2026), PP 39-55

Rethinking Student Satisfaction: Distinguishing Necessary and Sufficient Service Conditions in Higher Education

Kai Haverila, Jenny Twyford, Matti Haverila
Kamloops Canada

Abstract:
Purpose: This study aims to examine the drivers of student satisfaction in higher education by distinguishing between factors sufficient to influence satisfaction and those necessary for satisfaction to occur.
Design/methodology/approach: Survey data were collected from 394 undergraduate and graduate business students at a Canadian university. The study employs Partial Least Squares Structural Equation Modelling (PLS-SEM) to assess sufficiency relationships and Necessary Condition Analysis (NCA) to identify essential conditions for student satisfaction.
Findings: The results show that educational support services are the only significant predictor of student satisfaction and also constitute a necessary condition. In contrast, technology, infrastructure and social orientation do not exhibit significant effects and are not necessary conditions. The NCA results further reveal that minimum support service thresholds must be met to achieve higher levels of satisfaction.
Practical implications: The findings highlight the importance of prioritizing educational support services as a critical foundation for student satisfaction. Institutions should focus on achieving minimum service thresholds rather than uniformly increasing all service dimensions.
Originality/value: This study contributes to the literature by integrating sufficiency and necessity perspectives and demonstrating that key drivers of satisfaction are not always equivalent to essential conditions, thereby offering a more nuanced understanding of the formation of satisfaction in higher education.

Keywords: Student satisfaction; PLS-SEM; Necessary Condition Analysis.

I. Introduction

Student satisfaction has become a central performance indicator in higher education, reflecting not only the perceived quality of educational services but also influencing student retention, institutional reputation, and long-term sustainability (Arambewela & Hall, 2009; Buttle, 1996a). As universities increasingly operate in competitive and market-oriented environments, understanding the drivers of student satisfaction has attracted substantial scholarly attention. Prior research has identified multiple determinants, including teaching quality, support services, infrastructure, and social integration (Ackerman & Schibrowsky, 2007; Buttle, 1996a; Haverila et al., 2021). However, much of this research relies on linear, sufficiency-based approaches that assume that improvements in service attributes proportionally increase satisfaction.

From a theoretical perspective, student satisfaction research is grounded in expectation–confirmation theory (Oliver, 1977) and service quality frameworks such as SERVQUAL (Buttle, 1996a), which conceptualize satisfaction as a function of perceived service performance relative to expectations. In addition, the resource-based view (RBV) suggests that institutional resources—such as technological infrastructure and support services—can create value for students when effectively deployed. While these perspectives have advanced understanding of satisfaction formation, they largely emphasize sufficiency logic, overlooking the possibility that certain factors may act as necessary conditions that must be present before satisfaction can occur.

This study addresses this limitation by integrating Partial Least Squares Structural Equation Modelling (PLS-SEM) with Necessary Condition Analysis (NCA) to examine the drivers of student satisfaction in higher education. While PLS-SEM identifies statistically significant relationships (i.e., sufficient conditions), NCA introduces a complementary necessity logic that assesses whether specific factors are indispensable for achieving desired levels of satisfaction (Dul, 2016; Richter et al., 2020). Despite growing recognition of NCA in management and marketing research, its application in higher education service contexts remains limited.

Accordingly, the purpose of this study is to identify both the sufficient and necessary drivers of student satisfaction. Specifically, the study focuses on three key service dimensions: technology and infrastructure, educational support services, and social orientation, and examines their effects on overall student satisfaction. The

study pursues three main objectives: (1) to assess the impact of these service dimensions on student satisfaction using PLS-SEM; (2) to determine whether these dimensions constitute necessary conditions using NCA; and (3) to compare the insights generated by sufficiency and necessity logics.

The study contributes to the literature by addressing a critical research gap. While prior studies have identified key predictors of student satisfaction, they have largely neglected the distinction between constructs that are merely influential and those that are essential. This distinction is particularly important in educational service settings, where the absence of certain "must-have" elements may undermine satisfaction despite improvements in other areas. By combining PLS-SEM and NCA, this research provides a more nuanced understanding of satisfaction formation, extending recent methodological advancements in marketing and service research (Hair et al., 2022; Sukhov et al., 2021).

The importance of this research is both theoretical and practical. Theoretically, it advances satisfaction research by integrating sufficiency and necessity perspectives, offering a more comprehensive analytical framework. In practice, it provides actionable insights for higher education managers by identifying which service elements serve as critical thresholds for achieving student satisfaction, thereby supporting more effective resource allocation and service design.

The remainder of the paper is structured as follows. The next section reviews the relevant literature and develops the research hypotheses. This is followed by a description of the methodology, including data collection and analytical procedures. The results of the PLS-SEM and NCA analyses are then presented, followed by a discussion of the findings. The paper concludes with theoretical and managerial implications, limitations, and directions for future research.

II. Literature review

Educational services

Educational services refer to the overall bundle of academic and non-academic offerings provided by higher education institutions to facilitate student learning and development. These services encompass teaching quality, institutional support, infrastructure, and the broader learning environment that shapes student experiences (Aldridge & Rowley, 1998; Arambewela & Hall, 2009; Haverila et al., 2021). Within the service marketing domain, higher education is widely conceptualized as a complex, high-contact service system in which value is co-created through interactions between students and institutions (Grönroos, 2017).

Drawing on SERVQUAL (Buttle, 1996) and expectation–confirmation theory (Oliver, 1977), educational services influence satisfaction through the alignment between expected and perceived service performance. More recent perspectives also emphasize the role of service ecosystems and the student-as-customer logic (Goyzueta Mejía et al., 2025), in which multiple touchpoints—including academic delivery, administrative processes, and social integration—jointly determine perceived value (Plewa et al., 2016; Vargo & Lusch, 2016). However, prior research has largely examined these elements in isolation, often overlooking how service components interact and whether certain dimensions are indispensable for achieving satisfaction.

To address this complexity, the present study focuses on three key dimensions of educational services—technology and infrastructure, educational support services, and social orientation—which are frequently identified as critical determinants of student experiences (Arambewela & Hall, 2009; Elsharnouby et al., 2021).

Technology and infrastructure

Technology and infrastructure refer to the physical and digital resources that support teaching, learning, and student engagement, including access to learning technologies, computer labs, teaching aids, and modern facilities. These elements represent the tangible aspects of service delivery and are often considered foundational to educational quality (Arambewela & Hall, 2009).

From a theoretical standpoint, this construct aligns with the resource-based view (RBV) (Kraaijenbrink et al., 2010), which posits that institutional resources can create value by enhancing user experiences and supporting learning outcomes. In addition, technology acceptance models (TAM) highlight the importance of perceived usefulness and ease of use in shaping students' attitudes toward educational technologies (Davis, 1989; Scherer et al., 2019).

Empirical studies have consistently found that well-developed technological infrastructure positively influences student satisfaction, particularly in digitally mediated learning environments (Al-Fraihat et al., 2020; Limbu & Pham, 2023). However, recent research also suggests that the marginal impact of technology may diminish once a basic threshold is met, implying that technology may function more as a hygiene factor than a primary driver of satisfaction (DeShields et al., 2005; Herzberg, 2015; Pham et al., 2019). This raises important questions regarding whether technology and infrastructure are sufficient or necessary conditions for student satisfaction.

Educational support services

Educational support services refer to the administrative and academic assistance provided to students, including course registration, academic advising, career services, library access, and institutional procedures. These services help students navigate the educational system and achieve their academic goals (Hill, 1995).

Within service quality theory, support services are often categorized as functional quality elements that shape the overall service experience through responsiveness, reliability, and accessibility (Parasuraman et al., 1988). Furthermore, from a student engagement perspective, effective support services enhance students' sense of competence and institutional support, which are critical antecedents of satisfaction and persistence (Kahu & Nelson, 2018).

Recent studies highlight that educational support services are among the strongest predictors of student satisfaction, particularly in diverse and international student populations (Casidy, 2014; Hanssen & Solvoll, 2015). These services reduce uncertainty, improve perceived value, and strengthen institutional trust. Importantly, emerging evidence suggests that deficiencies in support services cannot easily be compensated for by improvements in other areas, indicating that they may function as necessary conditions for satisfaction (Momen et al., 2023; Reed & Watmough, 2015).

Social orientation

Social orientation refers to the institutional mechanisms that facilitate students' social integration, including counselling services, social activities, and orientation programs. This construct captures the extent to which students feel connected, supported, and integrated within the academic community (Arambewela & Hall, 2009).

Theoretical foundations for this construct can be found in social integration theory (Heyting et al., 2002) and student retention models, which emphasize that students' academic success and satisfaction are influenced by their ability to integrate socially and emotionally into the institutional environment (Tinto, 1993). In addition, relationship marketing theory highlights the importance of building long-term relational bonds between institutions and students (Hennig-Thurau et al., 2001).

Empirical research presents mixed findings regarding the impact of social orientation on student satisfaction. While some studies report a positive relationship (Schlesinger et al., 2017; Thomas, 2012), others suggest that its influence may be indirect or context-dependent, particularly when academic and support-related factors dominate the service experience (Elsharnouby et al., 2021). This inconsistency suggests that social orientation may not always be a primary driver of satisfaction, but its role as a potential necessary condition remains underexplored.

Student satisfaction

Student satisfaction is defined as the overall evaluation of the educational experience based on the comparison between expectations and perceived performance (Oliver, 1977). It represents a key outcome variable in higher education research, reflecting students' cognitive and affective responses to institutional services (Elliott & Healy, 2001).

Grounded in expectation–confirmation theory and customer satisfaction models, student satisfaction is influenced by multiple service dimensions and is associated with important outcomes such as retention, loyalty, and positive word-of-mouth (Alves & Raposo, 2007; Buttle, 1996). More recent studies also conceptualize satisfaction within value co-creation frameworks, emphasizing students' active role in shaping their own experiences (Vargo & Lusch, 2016).

Despite extensive research, most studies adopt a linear, sufficiency-based perspective, focusing on the relative importance of predictors. This approach assumes that increasing service quality dimensions will proportionally increase satisfaction. However, such models may overlook the possibility that certain factors must reach minimum threshold levels before satisfaction can occur. Addressing this limitation requires integrating necessity logic, as operationalized through Necessary Condition Analysis (Dul, 2016; Richter et al., 2020).

Hypotheses Development

Building on theoretical foundations and prior empirical findings, this study proposes relationships between key dimensions of educational services and student satisfaction. Drawing on expectation–confirmation theory (Oliver, 1977) and SERVQUAL (Buttle, 1996), student satisfaction is influenced by the perceived performance of institutional services relative to expectations. In addition, the resource-based view (RBV) suggests that institutional resources—such as technological infrastructure and support services—create value when they enhance student experiences.

Technology and infrastructure → Student satisfaction

Technology and infrastructure provide the foundational environment for teaching and learning. Research suggests that access to modern facilities and learning technologies enhances perceived service quality and supports academic performance (Al-Fraihat et al., 2020; Limbu & Pham, 2023). From an RBV perspective, these resources represent value-creating assets that improve service delivery. Therefore, higher levels of technological and infrastructural support are expected to positively influence student satisfaction. Thus, we propose the following hypothesis:

H1. Technology and infrastructure have a positive and significant impact on student satisfaction.

Educational support services → Student satisfaction

Educational support services facilitate students' academic journey by reducing administrative complexity and enhancing access to resources, including advising, career services, and libraries. According to service quality theory, these functional aspects of service delivery strongly influence satisfaction through reliability and responsiveness (Parasuraman et al., 1988). Empirical evidence consistently identifies support services as critical drivers of student satisfaction (Casidy, 2014; Hanssen & Solvoll, 2015). Thus, higher levels of educational support services are expected to increase student satisfaction. Thus, we propose the following hypothesis:

H2. Educational support services have a positive and significant impact on student satisfaction.

Social orientation → Student satisfaction

Social orientation supports students' integration into the institutional environment through counselling, orientation programs, and social activities. Based on social integration theory (Tinto, 1993), students who feel socially connected are more likely to experience positive educational outcomes. Relationship marketing theory further suggests that stronger relational bonds enhance satisfaction (Hennig-Thurau et al., 2001). Therefore, higher levels of social orientation are expected to positively influence student satisfaction. Thus, we propose the following hypothesis:

H3. Social orientation has a positive and significant impact on student satisfaction.

III. Methodology

The Sample

Survey data were collected from graduate and undergraduate classes at a Canadian university, with all participants enrolled as business majors. A multi-stage sampling approach was employed (Dudovsky, 2014). First, stratified sampling divided the population into groups based on education level (graduate vs. undergraduate). Within each group, non-probability sampling was then applied to encourage participation from students across a range of business school majors, including marketing, international business, accounting, finance, human resource management, entrepreneurship, economics, and supply chain management. Although the sample was limited to business students, the goal was to ensure broad representation across the school.

A total of 394 students responded to the survey. Prior to distribution, the purpose of the research was clearly explained to participants. Of these, 199 were paying domestic student fees and 195 were paying international student fees. Comparative analysis revealed no significant differences across gender, domestic versus international status, or undergraduate versus graduate status for any of the constructs of interest ($p < 0.001$). Therefore, all responses were combined for subsequent analysis. To minimize social desirability bias, the survey was administered anonymously, and the wording of items was kept as simple and clear as possible. Additionally, sensitive topics such as student grades were excluded to further reduce bias (Page et al., 2014).

Measurement and questionnaire development

The researchers developed a survey questionnaire, in which items were adapted from the existing literature and used to collect data on the key constructs (Table 1).

Table 1. Measurement scales of study variables in the conceptual model.

Construct	Indicator variable	#	Sourcea
Satisfaction	Satisfaction	SAT1	(Barry et al., 2008; Buttle, 1996b; Oliver, 1977; Tokman et al., 2007)
	Overall performance	SAT2	
Technology and infrstructure	Technology for learning purposes	TAI1	(Arambewela & Hall, 2009)
	Access to computer labs	TAI2	
	Modern facilities available for practicing presentations and holding meetings	TaI3	

	Teaching aids	TaI4	
Educational support services	Registration for courses	ESS1	(Hill, 1995)
	Academic advising	ESS2	
	Career center services	ESS3	
	Library	ESS4	
	Extracurricular services	ESS5	
	Admistrative procedures	ESS6	
Social orientation	Counseling services	SOC1	(Ackerman & Schibrowsky, 2007; Aldridge & Rowley, 1998; Arambewela & Hall, 2009)
	Social activities	SOC2	
	General orientation programs	SOC3	
	Program orientation	SOC4	

Structural model

The structural model (Figure 1) was developed based on the literature review and illustrates the research hypotheses.

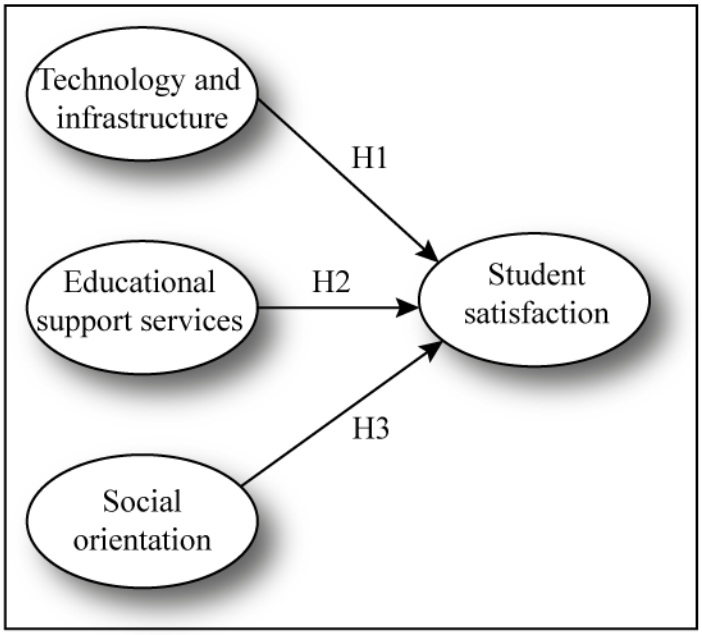


Figure 1. The structural model.

Method of statistical analysis

The model was analyzed using partial least squares structural equation modelling (PLS-SEM). Structural equation modelling can be conducted in two ways: covariance-based SEM (CB-SEM) and PLS-SEM, which differ in their underlying measurement philosophy and objectives (Hair et al., 2022). CB-SEM represents constructs as factors, whereas PLS-SEM represents them as components (Hair et al., 2022; Lowry & Gaskin, 2014). In addition, PLS-SEM provides access to statistical techniques not available in CB-SEM, such as Necessary Condition Analysis (NCA), which is applied in this study. Given the study's aim of predicting the target construct—student satisfaction—and identifying its key driver constructs, PLS-SEM was the appropriate choice. Current guidelines for evaluating the quality of measurement and structural models in PLS-SEM were followed (Ringle et al., 2020).

Necessary Condition Analysis (NCA) is a relatively recent analytical technique that is now incorporated into SmartPLS software (version 4.1.1.4). NCA is particularly useful because it identifies the extent to which a given condition must be present to achieve a certain outcome level. For example, in this research, NCA helps determine the degree of technology and infrastructure, educational support and social orientation services required to achieve specific levels of student satisfaction (Richter et al., 2020).

The logic of NCA distinguishes between "necessary" conditions (necessity logic) and "sufficient" conditions (sufficiency logic) in relation to the endogenous construct of student satisfaction (Dul, 2016; Sukhov et al., 2021). The analysis followed rigorous procedures outlined in the literature, including: defining research

objectives and theoretical background, preparing and verifying the dataset, running the standard PLS-SEM analysis, testing measurement model reliability and validity, transferring unstandardized latent variable scores to the dataset, conducting NCA, assessing the structural model, and interpreting the results (Richter et al., 2020). The interpretation of the results is based on the table presented in Appendix A.

IV. Data analysis

Preparation and checking of data

At this stage, the adequacy of the sample size, data distribution, the presence of outliers, and the measurement level/coding of scales are assessed (Richter et al., 2020). Sample adequacy was first assessed using Cochran's formula for continuous data (Cochran, 1977). With an alpha level of 0.025 in each tail (1.96), an estimated standard deviation of 0.8 on a 5-point scale, and a margin of error of 0.15 (5 × 0.03), the minimum required sample size was 137. Since the final dataset included 199 domestic and 195 international students, this requirement was exceeded. Sample adequacy was further evaluated for partial least squares structural equation modelling (PLS-SEM). Based on recent guidelines, if the smallest path coefficient in the structural model is 0.11 and the significance level is 0.05, the minimum required sample size is 155 (J. F. Hair et al., 2022). Thus, the achieved sample size was again confirmed to be sufficient.

Regarding data distribution, the performance of NCA or PLS-SEM is not constrained by any distributional assumptions (Richter et al., 2020). However, highly skewed data may inflate standard errors in statistical significance testing using bootstrap analysis, thereby reducing statistical power (Richter et al., 2020). To evaluate skewness (distribution balance) and kurtosis (peakedness), the data were analyzed using SPSS (version 26) (Table 2). Literature indicates that the most commonly used critical values for skewness and kurtosis are 2.58 (at a 0.01 significance level) and 1.96, respectively, corresponding to a 0.05 significance level (Hair et al., 2010). This suggests there is no significant kurtosis or skewness in the data. Normality tests are typically conducted using the Kolmogorov-Smirnov and Shapiro-Wilk tests. Both tests indicate significance (Table 3) for all variables, implying non-normality of the data. Despite the absence of skewness and kurtosis, the data exhibit non-normality, thereby reducing statistical power.

Regarding the assessment of outliers in the data, the literature recommends using the Mahalanobis distance in multivariate analysis, which identifies abnormal response combinations within the variable set (Grande, 2016; Hair et al., 2011). This analysis identified seven outliers in the dataset, which were subsequently removed. Lastly, scales were measured and coded using metric or quasi-metric scales with relationships based on Likert scales. This marks the end of the data preparation and verification phase for the PLS-SEM and NCA analysis.

Table 2. Mean values, standard deviations and normality of the data with z-scores for skewness and kurtosis

Construct	Variable *)	Mean	Std. Dev.	Skewness	Kurtosis	Kolmogorov-Smirnov	Shapiro-Wilk	Sign.
Satisfaction	SAT1	3.73	0.690	-0.896	1.447	0.377	0.752	<.001
	SAT2	3.13	0.777	0.038	0.727	0.284	0.855	<.001
Technology and infrstructure	TAI1	3.44	1.108	-0.323	-0.509	0.172	0.903	<.001
	TAI2	3.41	1.181	-0.368	-0.558	0.181	0.901	<.001
	TaI3	3.30	1.185	-0.100	-0.595	0.187	0.907	<.001
	TaI4	3.33	1.141	-0.201	-0.463	0.190	0.908	<.001
Educational support services	ESS1	3.78	0.925	-0.579	0.081	0.246	0.877	<.001
	ESS2	3.54	1.069	-0.535	-0.270	0.269	0.872	<.001
	ESS3	3.50	1.014	0.175	2.508	0.207	0.896	<.001
	ESS4	3.54	0.864	-0.159	-0.076	0.227	0.872	<.001
	ESS5	3.55	0.865	-0.642	0.516	0.285	0.857	<.001
	ESS6	3.66	0.783	-0.422	0.473	0.282	0.849	<.001
Social orientation	SOC1	3.44	1.108	-0.160	-0.100	0.237	0.901	<.001
	SOC2	3.36	1.004	-0.238	-0.002	0.244	0.889	<.001
	SOC3	3.45	1.036	-0.259	0.042	0.263	0.884	<.001
	SOC4	3.53	1.102	-0.051	0.201	0.267	0.886	<.001

*) See Table 1 for the shortcuts.

Evaluation of the reliability and validity of the measurement model

The initial step involved evaluating each individual scale used to measure the constructs. The assessment of the measurement model began with checking the reliability of the indicators. A bias-corrected and accelerated bootstrapping analysis was performed to determine the significance of the indicator variables. (see Table 3). Relationships found to be insignificant should be considered for removal. (Rosenbusch et al., 2018).

Table 3. Measurement model results

Construct	Variable *)	Outer loading	Outer weight	5% bias-corrected confidence intervals for the outer loadings	
				2.5%	97.5%
Satisfaction	SAT1	0.842	0.610	0.758	0.897
	SAT2	0.828	0.587	0.726	0.887
Technology and infrstructure	TAI1	0.795	0.222	0.601	0.881
	TAI2	0.869	0.333	0.762	0.925
	TaI3	0.860	0.253	0.758	0.909
	TaI4	0.867	0.365	0.781	0.938
Educational support services	ESS1	0.560	0.191	0.416	0.668
	ESS2	0.673	0.250	0.582	0.751
	ESS3	0.669	0.256	0.529	0.758
	ESS4	0.691	0.244	0.590	0.762
	ESS5	0.662	0.227	0.539	0.751
	ESS6	0.720	0.328	0.631	0.787
Social orientation	SOC1	0.690	0.232	0.493	0.794
	SOC2	0.834	0.332	0.737	0.904
	SOC3	0.903	0.391	0.852	0.945
	SOC4	0.763	0.275	0.577	0.853

*) See Table 1 for the shortcuts.

The next step in assessing the measurement model is evaluating internal consistency reliability (Table 4). It is important to note that Cronbach's alpha is a conservative measure of reliability. In contrast, composite reliability (with a target range of 0.70-0.95) tends to overestimate internal consistency. Thus, the actual reliability lies between these criteria, with the Cronbach alpha value serving as the lower bound and the composite reliability as the upper bound for internal consistency (Hair et al., 2022). Thus, the internal consistency reliability was acceptable. In terms of convergent validity, which is usually assessed using average variance extracted (AVE) values, the threshold of 0.50 should be exceeded (Table 5). To address the low AVE issue, the literature suggests removing variables with low loadings; therefore, variables ESS1 and ESS4 were removed. After this, the AVE values for all constructs were acceptable.

Table 3. Construct reliability and convergent reliability

Construct	Cronbach's Alpha	Composite Reliability	Average Variance Extracted (AVE)
Educational support services	0.747 (0.683) *)	0.825 (0.806) *)	0.441 (0.510) *)
Social orientation	0.813	0.877	0.642
Student satisfaction	0.567	0.822	0.698
Technology and infrastructure	0.872	0.911	0.720

*) After the removal of ESS1 and ESS4 variables.

Next, the discriminant validity was assessed, which shows how much a construct differs from other constructs (Hair et al., 2022). Current literature recommends using Heterotrait-Monotrait (HTMT) analysis, which evaluates the ratio of between-trait and within-trait correlations (Hair et al., 2022). Research has suggested that the HTMT values not exceed 0.90 (Henseler et al., 2014). None of the HTMT values exceeded this threshold value. Subsequently, the unstandardized latent variable scores were transferred to the dataset in preparation for the NCA.

Assessment of common method bias

Research also suggested using the full collinearity test as a variance-based SEM alternative to the common method bias test (Lindell & Whitney, 2001). This was used because it could influence the assessment of the measurement and structural models. The full collinearity investigation included both vertical and lateral collinearity evaluations based on the technique established by Kock and Lynn .(2012). A random variable is included in the dataset to connect all constructs to a dummy construct, with values ranging from 0 to 1. PLS-SEM was then

completed, and the VIFs were assessed. The structural model showed no collinearity issues because the VIF values were below the strict 3.3 level (Hair et al., 2018), indicating the absence of common method bias.

Assessment of endogeneity

Given the cross-sectional nature of the data and the use of perceptual measures, the potential for endogeneity cannot be fully ruled out. Endogeneity may arise from omitted variables, measurement error, or reverse causality, thereby biasing parameter estimates and threatening the validity of the results. Importantly, common method bias tests do not account for such issues, making it necessary to explicitly assess endogeneity.

To address this concern, the Gaussian copula approach was employed, following the procedure proposed by Park and Gupta (2012) and recent recommendations in PLS-SEM research (Hult et al., 2018). This method involves generating a copula term for each predictor and incorporating it into the structural model. A statistically significant copula term indicates the presence of endogeneity.

The results show that the copula terms were not statistically significant for the technology and infrastructure ($\beta = -0.270$, $p = 0.175$), for the educational support services ($\beta = 0.004$, $p = 0.988$), and the social orientation construct ($\beta = -0.098$, $p = 0.675$), suggesting that endogeneity is not a concern in the model. Therefore, the estimated path coefficients can be interpreted as unbiased.

Assessment of the structural model

Assessing collinearity is the initial step in evaluating the structural model because it reveals correlations among the exogenous predictors. Collinearity is usually measured using the variance inflation factors (VIF). All VIF values in the structural model were below 3, indicating no collinearity (JHair et al., 2011).

Next, predictive validity and relevance analyses were conducted, typically using R^2 and Stone and Geisser Q^2 values (Geisser, 1975; Stone, 1974). Extant research has established that R^2 values of 0.67, 0.33, and 0.19 are considered substantial, average, and weak, respectively (Chin, 1998). The R^2 and R^2-adjusted values of the endogenous construct of marketing agility were 0.138 and 0.131, respectively. These values are considered low, unsurprisingly, as the constructs examined in this study are not the primary factors influencing student satisfaction. Research has recognized that the Stone-Geisser Q^2 should be larger than 0 to indicate predictive relevance, which was the case here.

The final step in assessing the structural model is estimating the path coefficients. It is noteworthy, however, that reporting statistical significance alone is insufficient when presenting results (Sullivan & Feinn, 2012), and therefore, the effect size should also be noted (Cohen, 1992; Klein, 2005), as the effect size may be the most fundamental finding in the analysis. Furthermore, with an adequately large sample size, statistical analysis can reveal significant differences that are insignificant in practice. In contrast, effect sizes are not dependent on sample size and are thus comparable across different research projects (Hair et al., 2011). The values 0.02, 0.15, and 0.35 indicate that the exogenous constructs have small, medium, or large effect sizes, respectively (Hair et al., 2022) (Table 4). The results indicate that one of the relationships is statistically significant, i.e., the relationship between educational support services and student satisfaction, with an effect size of medium and small.

Table 4. The significance of the path coefficients and effect sizes.

Relationship	**Path coeffi-cient**	**5% bootstrapping confidence intervals**		**Signifi-cance**	**Effect size (f^2)**	**Effect size descriptor of the total effect**
		2.5%	**97.5%**			
Educational support services → Student satisfaction	0.33	0.23	0.43	Yes	0.12	Medium to small
Social orientation → Student satisfaction	0.05	-0.05	0.16	No	0.01	-
Technology and infrastructure → Student satisfaction	0.05	-0.05	0.15	No	0.01	-

Necessary condition analysis (NCA)

Besides showing the average relationships between exogenous and endogenous constructs through PLS-SEM, NCA offers a more detailed view of how different exogenous constructs contribute to the endogenous construct(s). This is often visualized with scatter plots between the exogenous and endogenous constructs, which can help identify necessary conditions (Richter et al., 2020). In this research context, specific levels of educational support services, social orientation and technology and infrastructure are needed to achieve a certain level of student

satisfaction. Therefore, the NCA performance helps researchers determine which endogenous constructs are essential and the extent to which an exogenous construct is needed to reach a targeted level of the endogenous construct (Sukhov et al., 2021).

The scatter plot diagrams usually feature two upward-sloping lines, known as the ceiling development-free disposal hull (CE-FDH) and the ceiling development-free disposal hull (CR-FDH) (see Appendix B). The difference between these two is that the CR-FDH is a direct line through the CE-FDH stepwise line. The point of these lines is that the larger the area in the upper-left corner, the more restrictions are imposed on student satisfaction by educational support services, social orientation, and technology and infrastructure in this research (Richter et al., 2020). Furthermore, this same information can be displayed using the bottleneck table. Table 5 shows that to achieve 90% student satisfaction, an educational support services score of at least 3.00, a social orientation score of at least 3.1, and a technology and infrastructure score of 1.9 are required.

Table 5. Bottleneck table - CE-FDH (values) (**Note**: NN = Not Necessary)

	Student satisfaction	**Educational support services**	**Social orientation**	**Technology and infrastructure**
0%	1.515	NN	NN	NN
10%	1.863	NN	NN	NN
20%	2.212	NN	NN	NN
30%	2.561	2.017	NN	NN
40%	2.909	2.017	NN	NN
50%	3.258	2.017	NN	NN
60%	3.606	2.592	NN	NN
70%	3.955	2.592	NN	NN
80%	4.303	2.741	NN	NN
90%	4.652	3.000	3.102	1.914
100%	5.000	3.000	3.102	1.914

The key measures of the NCA's effectiveness are ceiling accuracy and the necessity effect size (d). The ceiling accuracy is the proportion of observations at or below the ceiling line, calculated as the number of observations at or below the ceiling line divided by the total number of observations, then multiplied by 100. In this study, the accuracy was 100%. Comparing the observed accuracy to a benchmark value (e.g., 95%) helps evaluate the quality of the solution (Dul, 2016; Richter et al., 2020). The necessity effect size (d) and its statistical significance indicate whether a construct is necessary. d is determined by dividing the "empty" space, known as the ceiling zone, by the total scope of observations (Richter et al., 2020).

The effect sizes and their significance are illustrated in Table 6. Previous research has labelled $0 < d < 0.1$ as a small effect, $0.1 \leq d < 0.3$ as a medium effect, $0.3 \leq d < 0.5$ as a large effect, and $d \geq 0.5$ as a very large effect (Dul, 2016b).

Table 6. Necessary Condition Analysis (NCA) effect sizes and their permutation significance.

Construct	**CE-FDH effect size (d)**	**Permutation p-value**	**Effect size descriptor on the student satisfaction**
Educational support services	0.199	0.004	Medium
Social orientation	0.061	0.452	-
Technology and infrastructure	0.033	0.704	-

Interpretation of the results

The analysis results indicate that settings 1 and 4 are supported (see Appendix A). Based on the results in Table 6, the NCA is summarized in Table 7. Thus, educational support services are a necessary, “must-have” condition for student satisfaction.

Table 7. The scenarios in the interpretation of the NCA results

Setting	**PLS–SEM results**	**NCA results**	**Comment**	**Conclusion**
1. Educational support services. . .	significant determinant	and a necessary condition	On average, an increase in the educational support services will increase atudent satisfaction. However, a certain level of the	Must have!

			educational support services construct is necessary for Student satisfaction to manifest.	
2. Social orientation is a	insignificant determinant	and not a necessary condition	Social orinettaion construct is neither a must-have nor a should-have factor for the student satisfaction outcome.	-
3. Technology and infrastructure. . .	insignificant determinant	and not a necessary condition	Technology and infrastructure construct is neither a must-have nor a should-have factor for the student satisfaction outcome.	-

V. Discussion

The purpose of this study was to examine the drivers of student satisfaction in higher education by integrating sufficiency logic (PLS-SEM) with necessity logic (NCA). The findings provide several important insights into the nature of satisfaction formation and extend prior research by distinguishing between constructs that are merely influential and those that are essential.

The results from the PLS-SEM analysis indicate that educational support services are the only statistically significant predictor of student satisfaction, while technology, infrastructure and social orientation do not exhibit significant direct effects. These findings partially support the proposed hypotheses, providing support for H2, but not for H1 and H3. This result is consistent with prior research emphasizing the importance of functional service quality elements—such as advising, administrative processes, and access to resources—in shaping student satisfaction (Casidy, 2014; Hanssen & Solvoll, 2015). From a theoretical perspective, this finding reinforces the relevance of SERVQUAL and expectation–confirmation theory, which highlight the central role of reliable and responsive service delivery in satisfaction formation.

In contrast, the non-significant effects of technology, infrastructure, and social orientation suggest that these dimensions may not function as primary drivers of satisfaction in this context. This aligns with prior studies indicating that once a basic level of technological support is achieved, its marginal impact on satisfaction diminishes (Pham et al., 2019). Similarly, the mixed findings regarding social orientation suggest that its influence may be indirect or contingent on other service dimensions (Elsharnouby et al., 2021). These findings can be further interpreted through Herzberg's two-factor theory, which distinguishes between hygiene factors and motivators (DeShields et al., 2005). In this context, technology, infrastructure, and social orientation may operate as hygiene factors, whose presence prevents dissatisfaction but does not actively enhance satisfaction. Their non-significant effects in the PLS-SEM results, therefore, do not imply irrelevance but rather indicate that these elements must meet a minimum standard to avoid dissatisfaction, consistent with Herzberg's framework. These results highlight the limitations of relying solely on sufficiency logic, as non-significant relationships do not necessarily imply that these constructs are unimportant.

The NCA results provide a more nuanced interpretation. Specifically, educational support services are a necessary condition for student satisfaction, indicating that a minimum level of support must be present for satisfaction to occur. This finding is particularly important, as it demonstrates that even if improvements are made in other service dimensions, student satisfaction cannot be achieved without adequate support services. This reinforces the notion of "must-have" factors in service delivery and aligns with emerging research emphasizing the role of necessary conditions in management and marketing contexts (Dul, 2016; Richter et al., 2020).

In contrast, neither technology and infrastructure nor social orientation was found to be a necessary, "must-have" condition. This suggests that while these factors may contribute to the overall student experience, they do not impose binding constraints on satisfaction. In other words, students can still report satisfactory experiences even if these elements are not highly developed, provided that essential support services are in place. This distinction between necessary and non-necessary constructs provides important clarification to the existing literature, where these constructs are often treated as uniformly important.

Taken together, the combined PLS-SEM and NCA results highlight the importance of distinguishing between "drivers" and "enablers" of student satisfaction. Educational support services function as both a significant determinant and a necessary, "must-have" condition, making them a critical focal point for institutions. In contrast, technology, infrastructure, and social orientation appear to function as contextual or complementary constructs rather than as sufficient or necessary conditions.

This study advances the understanding of student satisfaction by demonstrating that traditional linear models may overlook critical threshold effects. By integrating sufficiency and necessity perspectives, the findings provide a more comprehensive explanation of how satisfaction is formed in higher education settings and underscore the importance of prioritizing essential service elements over purely incremental improvements.

VI. Implications

Academic implications

This study makes several important contributions to the literature on student satisfaction and service management in higher education. First, it advances existing research by explicitly distinguishing between sufficiency and necessity logics in explaining satisfaction. While prior studies have predominantly relied on linear, sufficiency-based approaches, the integration of PLS-SEM and NCA demonstrates that not all determinants operate in the same way. Specifically, the findings show that educational support services function as both a significant determinant and a necessary, "must-have" condition, whereas technology, infrastructure and social orientation are neither sufficient nor necessary. This distinction provides a more nuanced understanding of how student satisfaction forms and responds to recent calls for methodological pluralism in marketing and service research (Dul, 2016a; Richter et al., 2020a).

Second, the study contributes to theory by integrating Herzberg's two-factor theory into the context of higher education. The results suggest that educational support services can be conceptualized as motivators that actively enhance student satisfaction, whereas technology, infrastructure, and social orientation can be conceptualized as hygiene factors that prevent dissatisfaction but do not necessarily increase satisfaction beyond a certain threshold (DeShields et al., 2005). This theoretical framing helps reconcile inconsistent findings in prior research by explaining why some widely studied service dimensions exhibit weak or non-significant effects in linear models.

Third, the findings extend the application of the resource-based view (RBV) by demonstrating that not all institutional resources contribute equally to value creation. While RBV emphasizes the strategic importance of resources, this study shows that only certain resources—specifically educational support services—translate into meaningful performance outcomes in terms of student satisfaction. This highlights the need to differentiate between value-creating resources and threshold resources, thereby refining the application of RBV in service and education contexts.

Finally, the study contributes methodologically by illustrating the value of combining PLS-SEM with NCA in higher education research. This dual approach enables researchers to move beyond average effects and identify critical minimum thresholds required for outcomes to occur. As such, the study provides a template for future research aiming to capture the complexity of service phenomena, particularly in contexts characterized by multiple interacting determinants and non-linear relationships.

Practical implications

The findings provide clear guidance for higher education management on how to prioritize resources and design service strategies to enhance student satisfaction. First and foremost, educational support services should be treated as a non-negotiable priority. As the only construct that is both a significant determinant and a necessary condition, support services represent a "must-have" foundation. Institutions should therefore ensure consistent quality across academic advising, course registration, administrative procedures, and career services. The NCA results further indicate that minimum threshold levels must be met—for example, achieving high satisfaction (e.g., ~90%) requires support service performance to be approximately 3.0. Falling below this threshold is likely to constrain satisfaction regardless of improvements in other areas.

Second, the results suggest that technology and infrastructure, as well as social orientation, function as supporting or enabling factors rather than primary drivers. This implies that investments in these areas should prioritize adequacy over continuous maximization. For instance, while modern facilities and digital learning tools are important, their role is primarily to prevent dissatisfaction once baseline expectations are met. Overinvestment in these areas without strengthening core support services may yield limited returns.

Third, the findings highlight the importance of threshold-based resource allocation. Rather than pursuing uniform improvements across all service dimensions, managers should adopt a sequencing strategy: first ensure that essential support services meet required minimum levels, and only then allocate additional resources to enhancing complementary aspects such as social engagement and technological innovation.

Fourth, the results imply that student experience management should focus on removing critical bottlenecks. The bottleneck analysis demonstrates that a specific minimum level of social orientation (~3.1) is

required at higher satisfaction levels, suggesting that deficiencies in this area may become constraining only at advanced stages. Managers should therefore monitor service performance dynamically and address constraints as satisfaction targets increase.

These findings support a shift from a "more is better" mindset to a "right level matters" approach. Institutions should aim to identify and maintain optimal service thresholds rather than maximizing all service attributes indiscriminately. This approach enables more efficient use of limited resources while ensuring that the key conditions for student satisfaction are consistently met.

VII. Limitations and future research

This study is subject to several limitations that provide opportunities for future research. First, the data were collected using a cross-sectional survey design, which limits the ability to draw strong causal inferences. Although endogeneity was assessed and found not to be a concern, future studies could employ longitudinal or panel data to better capture dynamic relationships and potential feedback effects between service perceptions and student satisfaction.

Second, the sample comprises students from a single Canadian university and primarily from business disciplines, which may limit the generalizability of the findings. Institutional characteristics, cultural contexts, and disciplinary differences may influence how students evaluate service quality. Future research should replicate the study across multiple institutions, countries, and academic fields to enhance external validity.

Third, the study focuses on three key service dimensions—technology and infrastructure, educational support services, and social orientation. While these constructs are well-established in the literature, other potentially important determinants—such as teaching quality, perceived value, faculty interaction, and student engagement—were not included. Future research could extend the model by incorporating additional constructs and examining their roles as sufficient and/or necessary conditions.

Fourth, although the study integrates PLS-SEM and NCA, it relies on self-reported perceptual measures, which may be subject to response bias. While procedural and statistical remedies were applied, future research could benefit from incorporating objective indicators (e.g., academic performance, retention data) or multi-source data to strengthen validity.

Fifth, the findings suggest that some constructs may operate as threshold or hygiene factors, yet the study does not explicitly test nonlinear or interaction effects beyond the NCA framework. Future studies could explore nonlinear modelling approaches, configurational methods (e.g., fsQCA (Vis & Dul, 2018)), or moderation effects to further unpack the complexity of satisfaction formation.

Finally, future research could deepen the theoretical integration by examining how frameworks such as Herzberg's two-factor theory, resource-based view, and service-dominant logic jointly explain the distinction between necessary and sufficient conditions. Such work would further advance the conceptual understanding of service quality and satisfaction in higher education and related service contexts.

VIII. Conclusions

This study set out to examine the drivers of student satisfaction in higher education by integrating sufficiency logic (PLS-SEM) with necessity logic (NCA). The findings demonstrate that not all service dimensions contribute equally to satisfaction and that relying solely on linear models may lead to incomplete or misleading conclusions.

The results show that educational support services are both a significant determinant and a necessary condition for student satisfaction, highlighting their central role in shaping the student experience. In contrast, technology, infrastructure and social orientation were found to be neither significant determinants nor necessary conditions, suggesting that these factors function primarily as supporting elements rather than core drivers. Importantly, the NCA results reveal that minimum thresholds for certain services must be met for higher levels of satisfaction to be achieved, underscoring the importance of "must-have" conditions in service delivery.

By combining PLS-SEM and NCA, this study provides a more comprehensive understanding of the formation of satisfaction, demonstrating that what drives satisfaction is not always what enables it. The findings contribute to the literature by clarifying the distinction between essential and non-essential service elements and by integrating theoretical perspectives, including expectation–confirmation theory, the resource-based view, and Herzberg's two-factor theory.

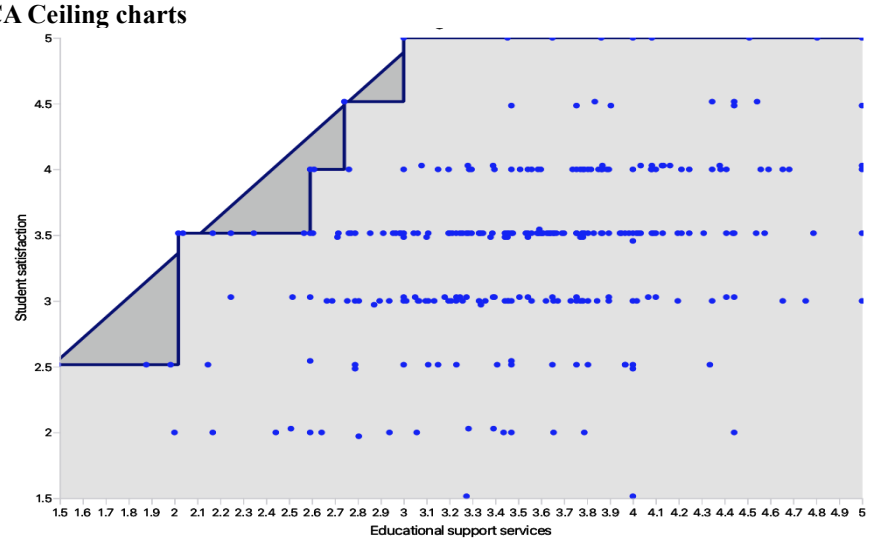
The study underscores the need for both researchers and practitioners to move beyond traditional linear approaches and adopt more nuanced frameworks that capture the complexity of service experiences. In doing so, it

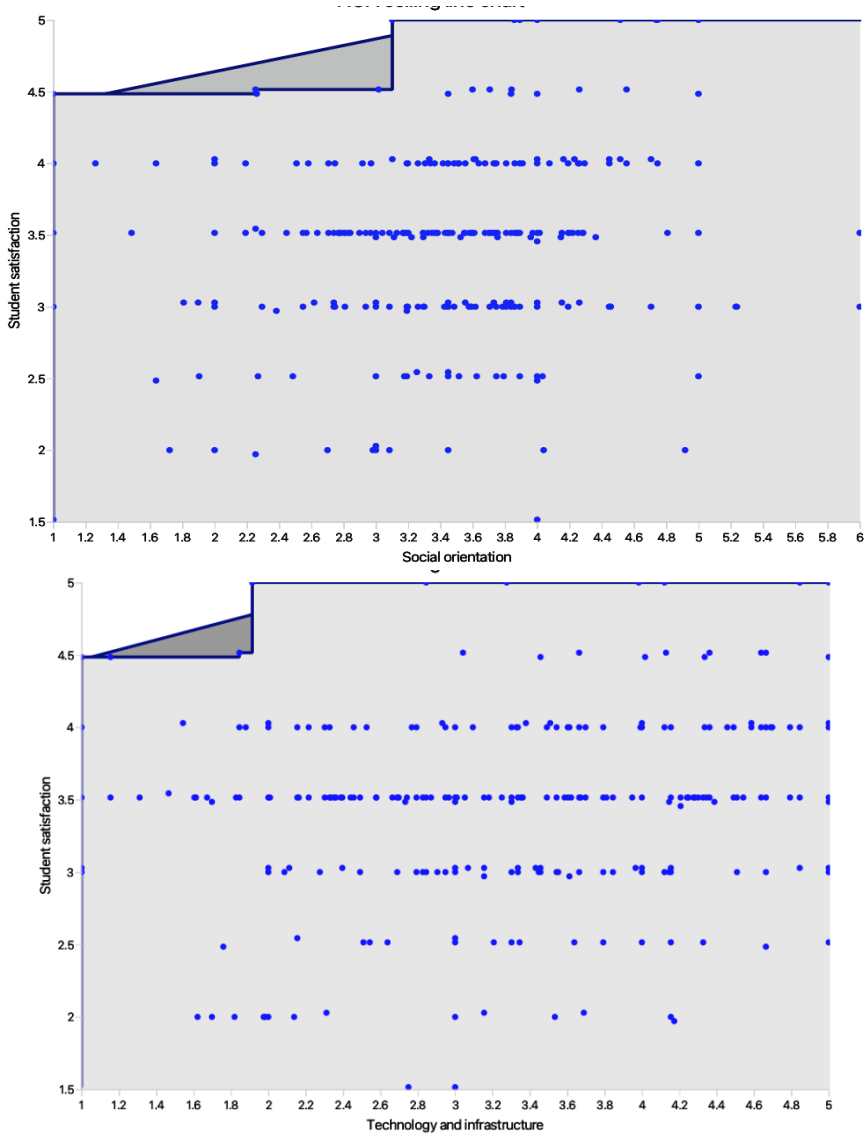
offers a stronger foundation for understanding and managing student satisfaction in contemporary higher education environments.

Appendix A. The scenarios for interpreting the NCA results (Source: Richter et al., 2020)

Setting	PLS–SEM results	NCA results	Conclusion
1. Exogenous construct is a. . .	significant determinant	and a necessary condition	On average, an increase in the exogenous construct will increase the outcome. However, a certain level of the exogenous construct is necessary for the outcome to manifest.
2. Exogenous construct is a. . .	significant determinant	but no necessary condition	On average, an increase in the exogenous construct will increase the outcome; no minimum level of the construct is needed to ensure that the outcome will manifest.
3. Exogenous construct is a. . .	nonsignificant determinant	but a necessary condition	A certain level of the exogenous construct is necessary for the outcome to manifest. However, a further increase is not recommended, as it will not increase the outcome any further.
4. Exogenous construct is a. . .	nonsignificant determinant	and not a necessary condition	Exogenous construct is neither a must-have nor a should-have factor for the manifest outcome.

Appendix B. NCA Ceiling charts





Bibliography

1. Ackerman, R., & Schibrowsky, J. (2007). A business marketing strategy for student retention: A higher education initiative. *Journal of College Student Retention: Research, Theory & Practice*, *9*(3), 307–336. https://doi.org/10.2190/CS.9.3.d
2. Aldridge, S., & Rowley, J. (1998). Measuring customer satisfaction in higher education. *Quality Assurance in Education*, *6*(4), 197–204. https://doi.org/10.1108/09684889810242182
3. Al-Fraihat, D., Joy, M., Masa'deh, R., & Sinclair, J. (2020). Evaluating E-learning systems' success: An empirical study. *Computers in Human Behaviour*, *102*, 67–86. https://doi.org/10.1016/j.chb.2019.08.004
4. Alves, H., & Raposo, M. (2007). Conceptual model of student satisfaction in Higher Education. *Total Quality Management & Business Excellence*, *18*(5), 571–588. https://doi.org/10.1080/14783360601074315
5. Arambewela, R., & Hall, J. (2009). An empirical model of international student satisfaction. *Asia Pacific Journal of Marketing and Logistics*, *21*(4), 555–569. https://doi.org/10.1108/13555850910997599
6. Barry, J. M., Dion, P., & Johnson, W. (2008). A cross-cultural examination of relationship strength in B2B services. *Journal of Services Marketing*, *22*(2), 114–135. https://doi.org/10.1108/08876040810862868
7. Buttle, F. (1996). SERVQUAL: review, critique, research agenda. *European Journal of Marketing, 30*(1), 8–32.

8. Casidy, R. (2014). Linking brand orientation with service quality, satisfaction, and positive word-of-mouth: Evidence from the higher education sector. *Journal of Nonprofit & Public Sector Marketing*, *26*(2), 142–161. https://doi.org/10.1080/10495142.2014.901004
9. Chin, W. W. (1998). Commentary: Issues and opinion on Structural Equation Modelling. *MIS Quarterly*, *22*(1), vii–xvi.
10. Cochran, W. G. (1977). *Sampling Techniques*. John Wiley & Sons.
11. Cohen, J. (1992). Things I Have Learned (so far). In *Methodological Issues and Strategies in Clinical Research* (Vol. 45, pp. 1304–1312). American Psychological Association. https://doi.org/10.1037/10109-028
12. Davis, F. D. (1989). *Technology acceptance model: TAM*. University of Michigan.
13. DeShields, O. W., Kara, A., & Kaynak, E. (2005). Determinants of business student satisfaction and retention in higher education: applying Herzberg's two-factor theory. *International Journal of Educational Management*, *19*(2), 128–139. https://doi.org/10.1108/09513540510582426
14. Dudovsky, J. (2014). *The Ultimate Guide to Writing a Dissertation in Business Studies.* BV Inc.
15. Dul, J. (2016). Necessary Condition Analysis (NCA). *Organizational Research Methods*, *19*(1), 10–52. https://doi.org/10.1177/1094428115584005
16. Elliott, K. M., & Healy, M. A. (2001). Key factors influencing student satisfaction related to recruitment and retention. *Journal of Marketing for Higher Education*, *10*(4), 1–11. https://doi.org/10.1300/J050v10n04_01
17. Elsharnouby, M. H., Mohsen, J., Saeed, O. T., & Mahrous, A. A. (2021). Enhancing resilience to negative information in consumer-brand interaction: the mediating role of brand knowledge and involvement. *Journal of Research in Interactive Marketing*, *15*(4), 571–591. https://doi.org/10.1108/JRIM-05-2020-0107
18. Geisser, S. (1975). The predictive sample reuse method with applications. *Journal of the American Statistical Association*, *70*(350), 320–328. https://doi.org/10.1080/01621459.1975.10479865
19. Goyzueta Mejía, Z., Consolación - Segura, C., & Barredo Ibáñez, D. (2025). The student as a customer in higher education: a systematic review (2000–2022). *Cogent Business & Management*, *12*(1). https://doi.org/10.1080/23311975.2025.2551388
20. Grande, T. (2016). *Identifying Multivariate Outliers with Mahalanobis Distance in SPSS*. https://www.youtube.com/watch?v=AXLAX6r5JgE
21. Grönroos, C. (2017). On value and value creation in service: A management perspective. *Journal of Creating Value*, *3*(2), 125–141. https://doi.org/10.1177/2394964317727196
22. Hair, J. F., Hult, G. T., Ringle, C., & Sarstedt, M. (2022). A Primer on Partial Least Squares Structural Equation Modelling (PLS-SEM). Sage.
23. Hair, J. F., Ringle, C. M., & Sarstedt, M. (2011). PLS-SEM: Indeed a silver bullet. *Journal of Marketing Theory and Practice*, *19*(2), 139–152. https://doi.org/10.2753/MTP1069-6679190202
24. Hair, J., Sarstedt, M., Ringle, C., & Gudergan, S. (2024). *Advanced Issues in Partial Least Squares Structural Equation Modelling*. Sage.
25. Hanssen, T.-E. S., & Solvoll, G. (2015). The importance of university facilities for student satisfaction at a Norwegian University. *Facilities*, *33*(13/14), 744–759. https://doi.org/10.1108/F-11-2014-0081
26. Haverila, M., Haverila, K., McLaughlin, C., & Arora, M. (2021). Towards a comprehensive student satisfaction model. *The International Journal of Management Education*, *19*(3), 100558. https://doi.org/10.1016/j.ijme.2021.100558
27. Hennig-Thurau, T., Langer, M. F., & Hansen, U. (2001). Modeling and managing student loyalty. *Journal of Service Research*, *3*(4), 331–344. https://doi.org/10.1177/109467050134006
28. Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8
29. Herzberg, F. (2015). Motivation-Hygiene Theory. In J. B. Miner (Ed.), *Organizational Behavior*. Routledge. https://doi.org/10.4324/9781315702018
30. Heyting, F., Kruithof, B., & Mulder, E. (2002). Education and social integration: On basis consensus and the cohesion of society. *Educational Theory*, *52*(4), 381.
31. Hill, F. M. (1995). Managing service quality in higher education: the role of the student. *Quality Assurance in Education*, *3*, 10–21.

32. Hult, G. T. M., Hair, J. F., Proksch, D., Sarstedt, M., Pinkwart, A., & Ringle, C. M. (2018). Addressing endogeneity in international marketing applications of partial least squares structural equation modelling. *Journal of International Marketing*, *26*(3), 1–21. https://doi.org/10.1509/jim.17.0151
33. Kahu, E. R., & Nelson, K. (2018). Student engagement in the educational interface: understanding the mechanisms of student success. *Higher Education Research & Development*, *37*(1), 58–71. https://doi.org/10.1080/07294360.2017.1344197
34. Klein, D. F. (2005). Beyond significance testing: Reforming data analysis methods in behavioural research. *American Journal of Psychiatry*, *162*(3), 643–644. https://doi.org/10.1176/appi.ajp.162.3.643-a
35. Kock, N., & Lynn, G. S. (2012). Lateral collinearity and misleading results in variance-based SEM: An illustration and recommendations. *Journal of the Association for Information Systems*, *13*(7).
36. Kraaijenbrink, J., Spender, J.-C., & Groen, A. J. (2010). The resource-based view: A review and assessment of Its critiques. *Journal of Management*, *36*(1), 349–372. https://doi.org/10.1177/0149206309350775
37. Limbu, Y. B., & Pham, L. (2023). Impact of e-learning service quality on student satisfaction during the Covid-19 pandemic: A systematic review. *Knowledge Management & E-Learning: An International Journal*, 523–538. https://doi.org/10.34105/j.kmel.2023.15.030
38. Lindell, M. K., & Whitney, D. J. (2001). Accounting for common method variance in cross-sectional research designs. *Journal of Applied Psychology*, *86*(1), 114–121. https://doi.org/10.1037/0021-9010.86.1.114
39. Lowry, P. B., & Gaskin, J. (2014). Partial Least Squares (PLS) Structural Equation Modeling (SEM) for Building and Testing Behavioral Causal Theory: When to Choose It and How to Use It. *IEEE Transactions on Professional Communication*, *57*(2), 123–146. https://doi.org/10.1109/TPC.2014.2312452
40. Momen, M. A., Sultana, S., Hoque, Md. A., Shahriar, S. H. Bin, & Ashif, A. S. M. (2023). Determinants of students' satisfaction with digital classroom services: moderating effect of students' level of study. *Asian Association of Open Universities Journal*, *18*(2), 160–175. https://doi.org/10.1108/AAOUJ-09-2022-0124
41. Oliver, R. (1977). *Satisfaction: A Behavioral Perspective on the Consumer*. Irwin/McGraw-Hill.
42. Page, M. J., McKenzie, J. E., Kirkham, J., Dwan, K., Kramer, S., Green, S., & Forbes, A. (2014). Bias due to selective inclusion and reporting of outcomes and analyses in systematic reviews of randomised trials of healthcare interventions. *Cochrane Database of Systematic Reviews*, *2015*(1). https://doi.org/10.1002/14651858.MR000035.pub2
43. Parasuraman, A. B. L. L. , Zeithaml, V. A., & Leonard Berry, L. (1988). SERVQUAL: A multiple-item scale for measuring consumer perceptions of service quality. *Journal of Retailing*, *64*(1), 12–37.
44. Park, S., & Gupta, S. (2012). Handling endogenous regressors by joint estimation using copulas. *Marketing Science*, *31*(4), 567–586. https://doi.org/10.1287/mksc.1120.0718
45. Pham, L., Limbu, Y. B., Bui, T. K., Nguyen, H. T., & Pham, H. T. (2019). Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. *International Journal of Educational Technology in Higher Education*, *16*(1), 7. https://doi.org/10.1186/s41239-019-0136-3
46. Plewa, C., Ho, J., Conduit, J., & Karpen, I. O. (2016). Reputation in higher education: A fuzzy set analysis of resource configurations. *Journal of Business Research*, *69*(8), 3087–3095. https://doi.org/10.1016/j.jbusres.2016.01.024
47. Reed, P., & Watmough, S. (2015). Hygiene factors: Using VLE minimum standards to avoid student dissatisfaction. *E-Learning and Digital Media*, *12*(1), 68–89. https://doi.org/10.1177/2042753014558379
48. Richter, N. F., Schubring, S., Hauff, S., Ringle, C. M., & Sarstedt, M. (2020). When predictors of outcomes are necessary: guidelines for the combined use of PLS-SEM and NCA. *Industrial Management & Data Systems*, *120*(12), 2243–2267. https://doi.org/10.1108/IMDS-11-2019-0638
49. Ringle, C. M., Sarstedt, M., Mitchell, R., & Gudergan, S. P. (2020). Partial least squares structural equation modelling in HRM research. *The International Journal of Human Resource Management*, *31*(12), 1617–1643. https://doi.org/10.1080/09585192.2017.1416655
50. Rosenbusch, J., Ismail, I. R., & Ringle, C. M. (2018). The agony of choice for medical tourists: a patient satisfaction index model. *Journal of Hospitality and Tourism Technology*, *9*(3), 267–279. https://doi.org/10.1108/JHTT-10-2017-0107

51. Scherer, R., Siddiq, F., & Tondeur, J. (2019). The technology acceptance model (TAM): A meta-analytic structural equation modeling approach to explaining teachers' adoption of digital technology in education. *Computers & Education*, *128*, 13–35. https://doi.org/10.1016/j.compedu.2018.09.009
52. Schlesinger, W., Cervera, A., & Pérez-Cabañero, C. (2017). Sticking with your university: the importance of satisfaction, trust, image, and shared values. *Studies in Higher Education*, *42*(12), 2178–2194. https://doi.org/10.1080/03075079.2015.1136613
53. Stone, M. (1974). Cross-validatory choice and assessment of statistical predictions. *Journal of the Royal Statistical Society: Series B (Methodological)*, *36*(2), 111–133. https://doi.org/10.1111/j.2517-6161.1974.tb00994.x
54. Sukhov, A., Lättman, K., Olsson, L. E., Friman, M., & Fujii, S. (2021). Assessing travel satisfaction in public transport: A configurational approach. *Transportation Research Part D: Transport and Environment*, *93*, 102732. https://doi.org/10.1016/j.trd.2021.102732
55. Sullivan, G. M., & Feinn, R. (2012). Using effect size—or why the p value is not enough. *Journal of Graduate Medical Education*, *4*(3), 279–282. https://doi.org/10.4300/jgme-d-12-00156.1
56. Thomas, L. (2012). *Building Student Engagement and Belonging in Higher Education at a Time of Change*. https://iicseonline.org/Study_Engagement_in_Higher_Education1.pdf
57. Tinto, V. (1993). *Leaving College: Rethinking the Causes and Cures of Student Attrition* . University of Chicago Press.
58. Tokman, M., Davis, L. M., & Lemon, K. N. (2007). The WOW factor: Creating value through win-back offers to reacquire lost customers. *Journal of Retailing*, *83*(1), 47–64. https://doi.org/10.1016/j.jretai.2006.10.005
59. Vargo, S. L., & Lusch, R. F. (2016). Institutions and axioms: an extension and update of service-dominant logic. *Journal of the Academy of Marketing Science*, *44*(1), 5–23. https://doi.org/10.1007/s11747-015-0456-3
60. Vis, B., & Dul, J. (2018). Analyzing relationships of necessity not just in kind but also in degree, complementing fsQCA with NCA. *Sociological Methods & Research*, *47*(4), 872–899. https://doi.org/10.1177/0049124115626179