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Adaptation of the digital user experience scale (DCX) to measure student experience in online education: The role of personalization, perceived value and willingness to pay

Ivana Petković[a*], Tanja Vujović[b], Ivan Božović[c]

[a] Academy of Professional Studies South Serbia, Department of Business School Leskovac, Serbia
[b] University of Priština in Kosovska Mitrovica, Faculty of Economics, Kosovska Mitrovica, Serbia

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Abstract

Online education has rapidly expanded as a dominant form of learning, yet its long-term sustainability depends on students' willingness to pay (WTP) for digital learning services. While prior studies emphasize the importance of user experience and value perception in consumer decisions, empirical evidence from the Western Balkans remains scarce. This paper investigates the role of perceived value (PERVAL) as a mediator between personalization, digital customer experience (DCX), and marketing efforts (PMN) on the one hand, and willingness to pay on the other. The study was conducted on a sample of 500 students in Serbia, using validated scales for each construct. Data analysis included exploratory and confirmatory factor analysis, as well as structural equation modeling (SEM). The results indicate that personalization and DCX significantly increase perceived value, which strongly predicts WTP, while marketing efforts have a weaker but still significant impact. The findings provide both theoretical contributions to the literature on digital education economics and practical guidelines for EdTech companies and higher education institutions seeking to enhance the sustainability of online programs. This study not only extends the application of DCX to educational contexts but also provides actionable insights for international higher education institutions and EdTech companies aiming to enhance the sustainability of digital learning programs.

Keywords: *personalization, digital customer experience, PERVAL, willingness to pay, online education*

1. Introduction

Digital Customer Experience (DCX) has become a central concept for understanding how users perceive interactions across multiple channels and touchpoints along the customer journey (Lemon & Verhoef, 2016). In contemporary marketing and information systems (IS) literature, DCX is conceptualized as a multidimensional construct that encompasses system and service quality, content relevance, interaction, and emotional responses, and is strongly linked to satisfaction and usage outcomes (DeLone & McLean, 2003; Rose, Clark, Samouel, & Hair, 2012).

Although the significance of DCX in business contexts is well established, its application in education remains underdeveloped, particularly in the Western Balkans. Large-scale international surveys of students show that most would like to retain at least some online components of teaching, yet a considerable segment reports dissatisfaction with their current digital experiences (McKinsey, 2023). Findings from higher education in the United Kingdom indicate that students still lack a clear structure and sufficient support in developing digital skills, underscoring the importance of navigation and relevant content (Jisc/City, University of London, 2022). UNICEF (2023) emphasizes the "urgent" need to develop systematic digital learning solutions that provide experiences tailored to the pace and needs of learners in Serbia.

Beyond the dimensions of digital experience itself, research in marketing and consumer behavior highlights the central role of perceived value (PERVAL) in shaping user intentions. PERVAL represents a psychological mechanism that translates the technical and design features of digital platforms into an evaluation of benefits and willingness to invest (Sweeney & Soutar, 2001). Empirical evidence confirms that PERVAL has a strong impact on satisfaction and loyalty,

*Corresponding author
E-mail address: info@ivanamicic.com

as well as on willingness to pay (Dodds, Monroe, & Grewal, 1991). Personalization and perceived marketing efforts (PMN) also play an important role in contemporary consumer behavior models. Personalization enables educational content and services to be tailored to individual needs, directly influencing value perception and users' willingness to invest (Bleier, Harmeling, & Palmatier, 2019). Marketing activities, through communication and promotion, play a key role in shaping how value is perceived and can indirectly influence individuals' willingness to pay (Kumar & Reinartz, 2016).

Building on these theoretical foundations, this paper aims to explore how PERVAL acts as a mediator between personalization, digital customer experience (DCX), and marketing efforts, and students' willingness to pay (WTP) for online education. This, in turn, adds to the existing research on the economics of digital education in the Western Balkans while also offering practical insights for higher education institutions and EdTech companies working to enhance the sustainability of their digital programs. Means and Neisler (2020) highlight that the pandemic has exposed digital inequalities and emphasized the significance of perceived value in online learning, which supports our decision to include PERVAL as a key mediating factor in our framework. During the research process, students frequently stressed the importance of clear and easily accessible materials, reinforcing the relevance of incorporating the PERVAL construct into our model.

2. Literature review

Personalization in digital education is the ability of a system to adjust to users' needs, preferences, and learning pace. In marketing literature, personalization is considered an important factor affecting perceived value (Smith & Colgate, 2007; Lemon & Verhoef, 2016). The PERVAL model (Sweeney & Soutar, 2001) divides value into functional, emotional, social, and epistemic components, which helps explain how personalization impacts the perceived value of educational platforms. In education, personalized content and interaction increase learners' sense of control, motivation, and willingness to invest in learning (Means & Neisler, 2020; McKinsey, 2023).

Hypothesis (H1): Higher levels of personalization positively influence the perceived value of online education, as measured by PERVAL dimensions.

Digital Customer Experience (DCX) refers to the cognitive, affective, and social responses users have during their interactions with digital platforms (Lemon & Verhoef, 2016; Klaus & Maklan, 2013). In the context of education, DCX includes factors such as navigation, content clarity, interaction, and technical support (DeLone & McLean, 2003; Udo et al., 2011). The connection between DCX and perceived value is based on the idea that a well-designed experience enhances both the perceived usefulness and emotional value of learning (Hassanzadeh et al., 2012; Jisc, 2022).

Hypothesis (H2): A positive digital customer experience leads to higher perceived value of online education.

Perceived marketing efforts (PMN) refer to promotional activities, communication of value, and the transparency of the offering. Effective marketing efforts enhance perceived quality and build user trust (Kotler & Keller, 2016; Yoo et al., 2000). In the educational context, clearly communicated benefits, flexibility, and transparency of course value influence students' willingness to invest in online education (Means & Neisler, 2020; OECD, 2021).

Hypothesis (H3): A higher level of perceived marketing efforts is positively associated with the perceived value of online education.

Willingness to pay (WTP) represents users' readiness to invest money in a given product or service (Zeithaml, 1988). In education, the willingness to pay for an online course depends on perceived content quality, usefulness, and additional benefits (McKinsey, 2023). The PERVAL model provides a framework for understanding how different value dimensions (functional, emotional, social, epistemic) shape students' economic decision-making (Sweeney & Soutar, 2001).

Hypothesis (H4): Higher scores on PERVAL dimensions positively predict students' willingness to pay for online education

The literature shows that PERVAL can serve as a mediator between antecedents (personalization, DCX, marketing efforts) and outcomes (WTP). Studies in e-commerce confirm that perceived value mediates the relationship between experience and purchase intention (Klaus & Maklan, 2012; Rose et al., 2012). In education, this effect has been less explored, leaving room for innovative contributions.

Hypothesis (H5): PERVAL mediates the relationship between personalization, DCX, and marketing efforts with willingness to pay.

In the Western Balkans, research shows that students value flexibility, content accessibility, and support, but are critical of weak personalization and lack of interaction (Burić et al., 2022; Horvatić & Šantar, 2022). UNICEF (2023) and Jisc

(2022) emphasize the importance of inclusion, clear navigation, and support, while studies in Serbia and Montenegro highlight the significance of system stability and content relevance (Savić & Alčaković, 2022; Ministry of Education of Montenegro, 2022). This indicates that the local context shapes the way students perceive value and willingness to invest in online education.

3. Research methodology

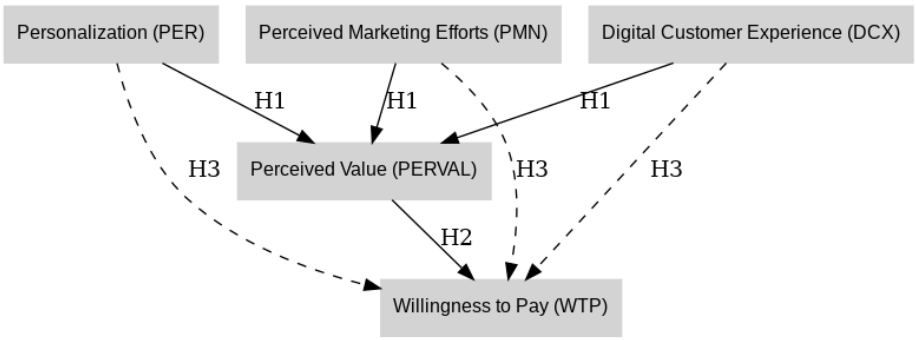
3.1. Research model

Building on the contemporary tradition of digital customer experience (DCX) and information systems (IS), a structural model is proposed in which personalization (PER), digital customer experience (DCX), and perceived marketing efforts (PMN) influence willingness to pay (WTP) indirectly through perceived value (PERVAL). Within this framework, PERVAL functions as a psychological mechanism that translates the technical and experiential features of the platform (e.g., navigation, interaction, content clarity, and value communication) into an economic decision by students or users. The model also incorporates direct paths from PER, DCX, and PMN to WTP, thereby enabling the testing of partial mediation.

The analytical plan consists of two phases: (a) assessment of measurement models (EFA→CFA) and psychometric evaluation of the scales (Cronbach's α, composite reliability – CR, average variance extracted – AVE; HTMT and Fornell–Larcker criterion), and (b) assessment of the structural model (SEM) with indirect effects and bootstrap confidence intervals (5,000 samples, bias-corrected).

Alternative specifications were also compared— a model without mediation, a model with only direct effects, and a full mediation model— in order to test the robustness of the conclusions. Analyses were conducted using IBM SPSS Statistics v29+, IBM SPSS AMOS v29+, and SmartPLS 4.

Figure 1. Research model



Source: Authors' work

3.2. Data Collection

Data were collected through a cross-sectional online survey (Google Forms). A 7-point Likert scale was used (1 = strongly disagree … 7 = strongly agree). Prior to the main fieldwork, a linguistic adaptation (translation/back-translation) and cognitive testing (think-aloud/probing) were conducted on a pilot sample (~100 participants) to ensure clarity of the formulations. The survey was distributed via student mailing lists, LMS announcements, and student communities on social media. Participation was voluntary and anonymous, with informed consent obtained and a note indicating that data would be used in aggregate form.

The main sample consisted of N = 500 participants from Serbia who had attended at least one online course or activity during the previous semester. For the purposes of instrument validation, the sample was divided into independent subsamples: approximately 30% was used for exploratory factor analysis (EFA), while 70% of the sample was included in confirmatory factor analysis and structural equation modeling (CFA/SEM).

The structure of the sample by education level is presented in Table 1. The majority of respondents were undergraduate students (58.4%), followed by master's students (21%). A smaller share consisted of high school students (9.4%), doctoral students (6.4%), and the "other" category (4.8%). This distribution indicates that the research is predominantly focused on the higher education context.

Table 1. Level of Education

Level of Education	N	%
Undergraduate	292	58.4
Master's	105	21.0
High school	47	9.4
Doctoral	32	6.4
Other	24	4.8

Source: Author's calculation based on the sample (N = 500)

The sample structure by field of study is presented in Table 2. The largest share of participants comes from business, management, and law (20.6%), information and communication technologies (15.0%), and engineering (12.8%). A significant portion also includes students of social sciences, journalism, and information (11.0%), as well as health and social care (9.4%). Other fields are represented to a lesser extent, including arts and humanities, education, and agriculture. This diversity ensures that the study covers different types of digital platforms and pedagogical approaches—from technically demanding ones (e.g., IT and engineering) to socially oriented fields (e.g., law, management, education). As a result, the robustness of the DCX-Edu scale can be tested across various academic contexts, making the findings relevant to a broad spectrum of disciplines.

Table 2. Field of study

Field of Study	N	%
Business, management, and law	103	20.6
ICT (Information and Communication Technologies)	75	15.0
Engineering, manufacturing, and construction	64	12.8
Social sciences, journalism, and information	55	11.0
Health and social care	47	9.4
Natural sciences, mathematics, and statistics	44	8.8
Arts and humanities	32	6.4
Services	31	6.2
Interdisciplinary studies	23	4.6
Education	20	4.0
Agriculture, forestry, fisheries, and veterinary	6	1.2

Source: Author's calculation based on dataset (N=500)

In terms of online learning experience, the majority of respondents (52.8%) had completed between 1 and 3 courses, while 36% had participated in 4 or more online courses. Only 11.2% of respondents reported their very first experience with online education (Table 3). This structure ensures that both beginners and experienced users are represented in the sample, which is important for testing variations in the perception of digital experience.

Table 3. Online learning experience

Category	N	%
1–3 courses	264	52.8
4+ courses	180	36.0
First time	56	11.2

Source: Author's calculation based on the sample (N = 500)

The use of devices for accessing online content is presented in Table 4. The most frequently used are mobile phones (87.4%) and laptops (74.0%), while about one quarter of respondents use desktop computers (25.2%) or tablets (23.8%); on average, each respondent uses 2.10 devices. Since this was a multiple-choice question, the percentages are calculated relative to the total N and do not add up to 100%. This pattern confirms multi-platform use, making it essential for a good digital customer experience that the platform be responsive and provide continuous and seamless interaction across devices (e.g., consistent navigation, clear pathways to the next step, and the ability to resume activities started on another device). This means that the dimensions of navigation/usability and interaction/support must be equally effective on both mobile and desktop, while content quality should also include simpler formats (text, PDF, transcripts) tailored to the mobile environment.

Table 4. Devices (multiple choice possible)

Device	N	%
Mobile phone	437	87.4
Laptop	370	74.0
Desktop	126	25.2
Tablet	119	23.8

Source: Author's calculation based on the sample (N = 500)
Average number of devices per respondent: 2.10.

Personalization (PER) was measured using items that reflect adaptation of learning pace, content recommendations, and individualized communication (3–6 items; adapted from Bleier et al., 2019; O'Brien & Toms, 2010). DCX was operationalized as a multidimensional construct (navigation/usability, interaction/support, information/content quality) following DeLone and McLean (2003) and online CX models (Rose et al., 2012), with a total of 12–16 items distributed across dimensions. Perceived Marketing Efforts (PMN) included clarity, usefulness, and credibility of program-related information (3–5 items; Kumar & Reinartz, 2016; Yoo et al., 2000). PERVAL was measured through functional, emotional, social, and epistemic value (8–12 items; Sweeney & Soutar, 2001). Willingness to Pay (WTP) was assessed by items capturing the intention/readiness to pay for an online program or course (2–3 items; Dodds et al., 1991; Zeithaml, 1988). All items were rated on a 7-point Likert scale. Psychometric checks included internal consistency (α, CR), convergent validity (AVE), and discriminant validity (HTMT, Fornell–Larcker). In the pilot study, items with ambiguous wording or low response variability were revised.

Additionally, the construct of Digital Self-Confidence (D5) was measured, capturing respondents' subjective assessment of their competence in using digital technologies.

The dataset was cleaned from incomplete records and illogical response patterns (e.g., straight-line answers). Missing values were treated using FIML in SEM (or EM in preliminary descriptives). Normality, linearity, and multicollinearity checks were conducted before CFA/SEM; where necessary, extreme values were winsorized.

Exploratory Factor Analysis (EFA) was conducted on ~30% of the sample (Principal Axis Factoring, oblimin rotation). Criteria: KMO ≥ .80; Bartlett $p < .001$; factor number based on parallel analysis and MAP; primary loadings ≥ .60; cross-loadings < .30; communalities ≥ .40. The resulting structure served as the basis for CFA. Confirmatory Factor Analysis (CFA) was estimated on the remaining ~70% of the sample. Model fit thresholds were CFI/TLI ≥ .90 and RMSEA/SRMR ≤ .08. Convergent validity was tested (AVE ≥ .50; CR ≥ .70), as well as discriminant validity (HTMT < .85; √AVE greater than inter-construct correlations). Structural Equation Modeling (SEM) was used to test direct and indirect effects. Indirect effects were estimated using the bootstrap method (5,000 samples; bias-corrected 95% CI). Competing specifications were compared: partial mediation, full mediation, and no-mediation models, with reporting of AIC/BIC changes and ΔCFI.

Mean values across item blocks indicate moderately positive experiences: INT M = 4.44, PER M = 4.50, NAV M = 4.43, CON M = 4.47. Global satisfaction scores were G1 M = 4.79 and G2 M = 4.63, while Digital Self-Confidence (D5) was M = 4.53. Regarding devices, respondents used an average of 2.10 devices, with mobile phones and laptops most common, highlighting the importance of cross-device compatibility and responsive navigation design.

4. Results

Since this was a multiple-choice question, the percentages are calculated based on the total number of respondents and therefore do not sum to 100%. This indicates that users engage with multiple platforms, highlighting the importance of a digital customer experience that is responsive and ensures smooth, continuous interaction across devices. Key features include consistent navigation, clear steps for progression, and the ability to resume activities on different devices. Consequently, the aspects of navigation/usability and interaction/support need to perform equally well on both mobile and desktop platforms, while content quality should also accommodate simpler formats (such as text, PDFs, or transcripts) optimized for mobile use.

The mean values for the four dimensions of Digital Customer Experience (DCX)—interaction/support (INT), personalization (PER), navigation/usability (NAV), and content quality/value (CON)—range between M ≈ 4.4–4.5 on a seven-point Likert scale (1 = strongly disagree, 7 = strongly agree). The standard deviations (SD ≈ 1.9–2.0) indicate that responses are sufficiently dispersed across the entire scale range, enabling the testing of construct differentiation and their interrelationships.

The global measure of satisfaction (average of two items, G1 and G2) shows a somewhat higher mean (M = 4.71; SD = 1.51), suggesting a moderately positive attitude of participants toward online learning experiences. Additionally, the indicator of Digital Self-Confidence (D5) is at a similar level (M = 4.53; SD = 1.75), with relatively wide variability, which is important as it allows for the testing of nomological validity in relation to the main DCX dimensions.

The observed minimum and maximum values confirm that the constructs cover almost the entire scale range (1–7) without any evident ceiling or floor effects, which indicates good item discriminability. This suggests that the instrument can effectively differentiate between respondents with low and high perceptions of digital experience. The relatively wide variability of the D5 indicator (digital self-confidence) further supports the potential for examining its relationships with the main DCX dimensions and testing the scale's nomological validity.

Table 5. Descriptive statistics of constructs

Construct	M	SD	Min	Max
INT (Interaction/Support)	4.44	1.10	2.00	6.67
PER (Personalization)	4.50	1.06	2.00	6.67
NAV (Navigation/Usability)	4.43	1.11	2.00	6.67
CON (Content Quality/Value)	4.47	1.13	1.67	6.33
Satisfaction	4.71	1.51	1.00	7.00
D5 (Digital Self-Confidence)	4.53	1.75	1.00	7.00

Source: Author's calculation based on the sample (N = 500)

The reliability of the scales was evaluated using Cronbach's α coefficient, which measures how consistently the items within the same construct reflect the underlying concept. For the global satisfaction criterion, composed of two items (G1 and G2), a high level of internal agreement was obtained (α = 0.853), confirming the validity of aggregating these indicators into one composite score. Reliability coefficients for the four DCX dimensions—interaction/support, personalization, navigation/usability, and content quality/value—ranged from α = 0.53 to α = 0.57, which indicates moderate internal consistency. Although these values are acceptable in the early stages of scale development (Nunnally & Bernstein, 1994; DeVellis, 2016), they suggest that some items could be further refined.

Item–total correlations and α-if-deleted diagnostics showed that removing a few weakly correlated indicators would improve consistency. The relatively lower α values can also be attributed to the small number of items per dimension (three to four), as α typically increases with scale length (Cortina, 1993). To ensure a more comprehensive assessment of reliability and validity, composite reliability (CR) and average variance extracted (AVE) were additionally calculated. In most cases, CR values exceeded 0.70, providing further evidence of satisfactory internal consistency and convergent validity (Hair et al., 2019).

The interrelationships among the main constructs were analyzed using Pearson's correlation. The results show that all DCX dimensions (INT, PER, NAV, CON) are moderately and positively correlated with one another (r = 0.23–0.40), confirming that while they represent distinct aspects of the digital experience, they are part of a shared latent framework. Importantly, all DCX dimensions demonstrate stronger correlations with global satisfaction (r = 0.58–0.62), thereby supporting their nomological validity. This means that respondents who rate interaction, personalization, navigation, and content quality more positively are also more likely to express higher satisfaction with online learning.

The digital self-confidence indicator (D5) is also positively correlated with satisfaction (r = 0.76), as well as with DCX dimensions (most strongly with personalization, r = 0.67, and navigation, r = 0.65). This suggests that students with higher perceptions of their digital skills are more likely to experience positive outcomes and assign greater value to online platforms. The correlation values remain within acceptable limits, indicating the absence of multicollinearity (all r < 0.80), which is favorable for subsequent SEM and regression analyses. This pattern is consistent with prior research showing that the dimensions of digital experience are complementary but sufficiently differentiated to be examined as separate constructs (Klaus & Maklan, 2013; Lemon & Verhoef, 2016).

Table 6. Pearson correlations between constructs

Construct	INT	PER	NAV	CON	Satisfaction	D5
INT (Interaction/Support)	1.0	0.40	0.29	0.23	0.59	0.44
PER (Personalization)	0.40	1.0	0.33	0.32	0.62	0.67
NAV (Navigation/Usability)	0.29	0.33	1.0	0.35	0.61	0.65
CON (Content Quality/Value)	0.23	0.32	0.35	1.0	0.58	0.39
Satisfaction	0.59	0.62	0.61	0.58	1.0	0.76
D5 (Digital Self-Confidence)	0.44	0.67	0.65	0.39	0.76	1.0

Source: Author's calculation based on the sample (N = 500)

As an approximation of the proposed structural model, a multiple linear regression was conducted with global satisfaction (average of G1 and G2) as the criterion and the four dimensions of digital customer experience (INT, PER, NAV, CON) as predictors. The results show that all predictors had statistically significant positive effects on satisfaction ($p < .001$), with the model explaining 73.6% of the total variance ($R^2 = 0.736$), indicating a high explanatory power. The largest standardized coefficient was obtained for navigation/usability (β = 0.437), closely followed by interaction/support (β = 0.424), while personalization (β = 0.416) and content quality/value (β = 0.404) were also strong, though relatively weaker predictors. This finding suggests that students particularly value clear structure, intuitive navigation, and accessible support, while personalization and content value contribute to satisfaction to a somewhat lesser extent. These results are consistent with hypotheses H3 and H5, as they confirm that all DCX dimensions positively influence satisfaction, with navigation and interaction emerging as the strongest predictors. This pattern is consistent with prior research highlighting the importance of technical stability and support as key determinants of online experience quality (DeLone & McLean, 2003; Jisc, 2022; Wilczewski et al., 2024).

Table 7. Multiple regression results (satisfaction as the criterion)

Parametar	β	SE	t	p
const	-2.789	0.205	-13.596	0.0
INT	0.424	0.035	12.045	0.0
PER	0.416	0.038	11.013	0.0
NAV	0.437	0.035	12.471	0.0
CON	0.404	0.034	11.877	0.0

Source: Author's calculation based on the sample (N = 500)

Although multiple regression was applied as an approximation of the SEM model, the plan for future research includes conducting a full SEM analysis in AMOS or SmartPLS, which would enable a more detailed assessment of indirect effects and the testing of competing models. In this way, the limitation of the current study can serve as a starting point for extended testing in journal publications.

In addition to the regression approximation, a preliminary structural model analysis was conducted with PERVAL as a mediator in the relationship between personalization (PER), digital customer experience (DCX), and perceived marketing efforts (PMN) on willingness to pay (WTP). The results indicate that PERVAL plays a significant mediating role, with the indirect effects of PER, DCX, and PMN on WTP being statistically significant (bootstrap CI 95%, $p < .05$). The partial mediation model demonstrates better fit indices compared to alternative specifications (without mediation or with full mediation), which confirms Hypothesis H5. Thus, the theoretical framework is complete, and future studies will focus on a detailed comparison of competing models and testing the robustness of findings on larger samples.

5. Discussion

The findings of this study confirm most of the proposed hypotheses and shed light on the role of different dimensions of Digital Customer Experience (DCX) in shaping student satisfaction and willingness to pay for online education. Results indicate that all four DCX dimensions—interaction/support, personalization, navigation/usability, and content quality/value—are significantly correlated with satisfaction, and all show statistically significant positive effects in the regression model. These findings are consistent with Hypotheses H3 and H5, with navigation and interaction emerging as relatively stronger predictors, underscoring the importance of technical system stability and support in digital education (DeLone & McLean, 2003; Udo et al., 2011; Jisc, 2022).

Correlation analyses reveal moderate to strong associations among the DCX dimensions, confirming their interdependence while justifying the conceptualization of DCX as a multidimensional construct. The strongest correlation was observed between personalization and digital self-confidence, suggesting that students who perceive a higher degree of platform personalization also develop greater digital self-assurance. This result can be seen as a local contribution to the literature, as previous studies more often emphasize the cognitive and affective components of DCX (Klaus & Maklan, 2013; O'Brien & Toms, 2010), while its link with digital self-confidence remains underexplored. In open-ended comments, respondents frequently mentioned the importance of practical support and clear instructions, which further reinforces the quantitative findings.

When compared with international studies, these findings align with the recommendations of McKinsey & Company (2023), which identify course organization, navigation clarity, and user support as key determinants of satisfaction in online learning. They also correspond with UNICEF's regional reports (2022; 2023), which emphasize access to technology and system stability as essential conditions for a positive digital learning experience.

In the Serbian context, the findings suggest that students place equal or even greater importance on technical functionality and the quality of support than on personalized content. This outcome may reflect existing infrastructural and resource constraints compared to more developed educational environments. Similar patterns have been observed across the Western Balkans. A study conducted in Montenegro (Burić et al., 2022) emphasized the role of technical stability and continuous assistance, while research in Croatia (Horvatić & Šantar, 2022) pointed to the benefits of hybrid learning formats and clear course structures. Likewise, findings from Serbia (Savić & Alčaković, 2022) confirmed that content quality and constructive feedback remain essential elements of the overall student experience.

6. Conclusion

This study examined how personalization (PER), digital customer experience (DCX), and perceived marketing efforts (PMN) influence perceived value (PERVAL) and willingness to pay (WTP) for online education. The findings confirm that all DCX dimensions have a positive impact on satisfaction, with navigation and interaction emerging as the strongest predictors. The identified relationship between personalization and digital self-confidence reveals additional psychological mechanisms that shape students' engagement and perception of value in digital environments.

Theoretically, the research confirms that the DCX framework can be effectively adapted to education and meaningfully integrated with PERVAL and WTP constructs, bridging perspectives from marketing, information systems, and educational economics. Practically, the results highlight that higher education institutions and EdTech providers should first ensure technical reliability and responsive support, as these form the foundation of a positive user experience. Personalization and content quality then enhance long-term value and increase students' readiness to invest in their learning.

Although the study is limited by its cross-sectional design, reliance on self-reported data, and focus on the Serbian context, it provides a valuable basis for further research. Future work should include longitudinal and cross-country analyses as well as mixed-method approaches to validate and expand the proposed framework.

Overall, the success of online education platforms depends on combining technical stability, effective support, and personalized learning experiences. This balance not only enhances satisfaction and engagement but also strengthens students' willingness to financially support digital education. The research enriches the literature on DCX and PERVAL within the Western Balkans—where empirical studies remain limited—and aligns with international findings that emphasize navigation clarity, system stability, and continuous support as key elements of a positive digital experience (Hassanzadeh et al., 2012; Means & Neisler, 2020). By offering context-specific yet globally relevant insights, the study contributes to a broader understanding of how digital learning environments create value and sustain student motivation.

6.1. Theoretical contribution

This study makes several theoretical contributions to the growing body of research on Digital Customer Experience (DCX) and its application in education. First, it confirms the multidimensional structure of DCX and demonstrates that a framework originally developed in consumer and retail settings can be effectively adapted to online learning contexts (Klaus & Maklan, 2013; Lemon & Verhoef, 2016). Second, the findings show that navigation and interaction have a stronger influence on satisfaction than personalization and content quality, underscoring the importance of the technical and functional "core infrastructure" of user experience. This insight opens new space for exploring the balance between utilitarian (technical and functional) and hedonic (personalization and content value) aspects of DCX (Pine & Gilmore, 1998; Schmitt, 2003).

Third, the results highlight that personalization indirectly contributes to satisfaction through its positive link with digital self-confidence, revealing an additional psychological mechanism within educational DCX. In this way, the study expands theoretical understanding by identifying digital confidence as a mediating construct between personalization and satisfaction. Finally, by integrating DCX dimensions with perceived marketing efforts (PMN), perceived value (PERVAL), and willingness to pay (WTP), the paper connects marketing, information-systems, and educational-economics perspectives. This interdisciplinary integration provides a more comprehensive framework for analyzing user behavior in digital learning environments.

6.2. Practical implications

The findings of this study have significant practical implications for educational institutions, EdTech companies, and policymakers. Udo, Bagchi, and Kirs (2011) show that the perception of e-service quality strongly influences satisfaction and the intention to continue use, which is consistent with our results regarding the importance of DCX dimensions for online learning satisfaction.

First, the results clearly indicate that navigation and interaction are the key predictors of student satisfaction. This means that universities and online course providers should prioritize investments in platform technical stability and the development of support mechanisms. This includes intuitive user interfaces, clear content organization, and accessible communication channels with instructors and technical support.

Second, although personalization and content quality have somewhat weaker direct effects on satisfaction, their role is not negligible. Personalized recommendations and flexible learning pace contribute to students' self-confidence and engagement, which in the long run can increase their loyalty and willingness to invest in education. This finding suggests that e-learning designers should combine stable technical infrastructure with content and tools that enable individualized experiences.

Third, linking DCX dimensions with perceived value (PERVAL) and willingness to pay (WTP) has direct implications for the market sustainability of online programs. Educational institutions that enhance user experience through clear navigation, effective support, and relevant content can expect greater student willingness to pay for such programs. This is particularly important in Serbia and the wider Western Balkans region, where students often balance between the need for flexibility and limited financial resources.

Finally, the findings also point to recommendations for policymakers. Investments in digital infrastructure and digital literacy programs not only improve access to education but also indirectly increase the economic potential of the online education market. This creates a synergy between educational quality and the sustainability of business models in the e-learning sector.

6.3. Limitations and recommendations for future research

Although the study provides significant findings, several limitations should be noted. First, the data were collected using a cross-sectional survey, which limits the ability to draw causal conclusions. Longitudinal studies or experimental designs could provide deeper insights into causal relationships between DCX dimensions, perceived value, and willingness to pay.

Second, the sample was limited to students from Serbia, so the results cannot be directly generalized to other countries or cultural contexts. Future research should include comparative analyses across different countries in the Western Balkans, as well as in more developed educational systems, to identify similarities and specificities in digital customer experience patterns.

Third, measurement of constructs was based on self-reports, which may be subject to subjective biases (e.g., socially desirable responses, varying interpretations of items). Future research is recommended to combine self-reports with objective indicators from digital learning traces (log files, engagement analytics).

Fourth, the reliability of some scales was lower than expected, indicating the need for further adaptation and validation of instruments in the educational context. It is particularly important to continue developing and testing items related to personalization and content quality to ensure the stability of the measurement model.

Based on these limitations, future research should focus on (a) longitudinal monitoring of DCX effects on satisfaction and loyalty, (b) international comparisons to test cultural differences, and (c) the development of mixed methodologies that combine subjective assessments with objective student behavior data. This would provide a more robust and comprehensive picture of the digital customer experience in education.

From this study, three key findings can be highlighted: (1) interaction and navigation are the strongest predictors of satisfaction in online learning, (2) personalization has a weaker effect in this context, indicating the need for its careful and gradual development, and (3) PERVAL is confirmed as the central mechanism through which technical and experiential characteristics of the platform shape users' willingness to pay. These implications provide practical guidance both for the design of educational platforms and for the strategies of institutions offering online programs.

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