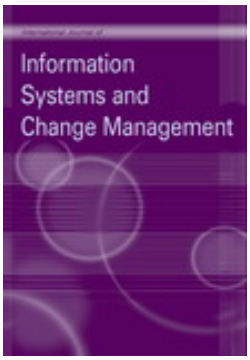

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Evaluation of digital library continuous usage: role of digital library overall quality, perceived usefulness and user satisfaction

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Evaluation of digital library continuous usage: role of digital library overall quality, perceived usefulness and user satisfaction

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Abstract: The study investigates the role of digital library overall quality (DLOQ), perceived usefulness (PU) and users' satisfaction (US) in digital library continuous usage intention (DLCUI) among students at higher education institutions (HEIs). For this purpose, the data was collected from the 531 students pursuing post-graduate studies at privately owned universities based in Uttarakhand, India. The findings of the study indicate that service quality (SRVQ), system quality (SYSQ) and information quality (INFQ) are significantly important elements of DLOQ. Further, DLOQ is found to exert influence on perceived usefulness (PU), which subsequently influences users' satisfaction (US) and DLCUI. The mediating role of user satisfaction (US) between PU and DLCUI is also confirmed. The study provides significant recommendations to the stakeholders in HEIs for enhancing students' continuing usage intentions towards the digital library.

Keywords: digital library; user satisfaction; perceived usefulness; DLOQ; digital library overall quality; continuous usage intention.

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1 Introduction

Higher education institutions (HEIs) are one of the primary centres of research and innovation contributing to innovation productivity (Serafini et al., 2022; Kolomytseva and Pavlovska, 2020), through its academic and research capabilities, strengthened and advanced through continuous and consistent scholarly efforts of its students. For long, the academic need for knowledge of these students has been fulfilled by the physical libraries set up under institutional premises.

The information and communication technology (ICT) evolution facilitated physical knowledge content to be preserved in digital space which could contain countless knowledge databases for the research community in form of a digital library (Upasani, 2016). Digital library has the capability to become accessible to remote end-users anytime anywhere fulfilling their search for knowledge content (Joshi et al., 2020; Omotayo and Haliru, 2019). Thus, digital libraries have emerged as a significant tool in hands of students helping them feed their requirement for knowledge, thereby fostering academic and research activities HEIs. With an increasing focus on building research and innovation capabilities among teacher and student/scholar fraternity, digital library systems have been set up at HEIs, providing membership-based access to high-quality research databases and a wide range of digital content, to students, teachers and research scholars over the campus network. However, the utilisation of digital libraries among students has not been encouraging and has become a cause of concern, especially among scholars and students (Tsekea and Chigwada, 2021). Students primarily consult internet resources while searching for information for academic purposes (Lo and Chu, 2015). Generally, digital libraries are not the first choice for students to complete their academic assignments or develop their knowledge. Therefore, students need to be made aware

about advantages of digital libraries. The digital library adoption among students needs to be investigated from various perspectives. Though digital library adoption among the students has been focused upon by few studies (Izuagbe et al., 2016; Khan and Qutab, 2016; Luo et al., 2021; Moorthy et al., 2018; Okocha, 2020; Rafique et al., 2020; Rahmat et al., 2022). The findings show that if high-quality services are provided, students are willing to use the digital library. Hence it is imperative to evaluate student's continuous usage intention for digital libraries.

The initial acceptance of an information system has been widely assessed by researchers utilising technology acceptance model (TAM) (Davis et al., 1989), which, however, faced limitations in measuring continued usage, an indication of success of information system. DeLone and McLean (1992) proposed information system success (ISS) model and presented key constructs, namely, service quality, information quality, system quality, use, user satisfaction and net benefits to assess the success of an information system. Further Seddon and Kiew (1996) observed 'perceived usefulness' to be more appropriate than 'use' to capture the underlying success construct. Hence we utilise the perceived usefulness and user satisfaction as key constructs along with above mentioned quality dimensions, from the modified ISS model (Seddon and Kiew, 1996) for evaluation of continuous usage of digital library.

2 Literature review

The majority of studies pertaining to the digital library have focused on studying and suggesting the quality framework and evaluation models for digital libraries. A conceptual model was proposed by Ahmad and Abawajy (2014), which suggested that service quality features of a digital library are influenced by third-party sourced service features along with the internal (digital library system perspective) and external features (end-user perspective). In a user-centred study among the editors and registered/ unregistered users on the evaluation of digital libraries, Demir and Parraci (2018) argued that usefulness and usability of digital library system jointly impact user satisfaction and in turn are greatly affected by open access nature of the system. Li and Liu (2019) attempted to bring in the users' criteria for the digital library investigation, like interface usability, user satisfaction and service quality into the focus of discussion and established that there are discrepancies between how users perceive the evaluation criteria as important and their actual evaluation. Xie et al. (2018) established the consensus as well as the difference among the multiple stakeholders towards the importance that they hold towards evaluation criteria. The research work on a user-oriented examination was further enhanced by Li and Liu (2019) by establishing the task characteristics for digital library evaluation. They suggested that task characteristics significantly affect users' evaluation of digital library performance. Also, user characteristics play a crucial part in its interaction with digital library systems. Individuals' cognitive style influences the way interaction takes place with digital systems during the information search and evaluation process. It further impacts the perception built up during the process as well as the overall work performance. Numerous external factors such as habit, domain knowledge, and system quality have an impact on how users adopt and use digital library systems (Rafique et al., 2020).

Students' inclination to use and refer to electronic academic resources could drive them further to adopt and use digital library services at institutions. In this direction, Farzana et al. (2021) attempted to understand the usage intention for e-books among graduate and postgraduate students at private universities in Thailand. Their findings reported positive attitudes and intention to use e-books by students when they perceive it to be useful and easy to use. Okocha (2019) worked on similar lines focusing on university students in Nigeria and used the UTAUT model to suggest various factors with gender playing a significant moderating role in e-books adoption. Looking up to macro-environmental determinants, Potnis et al. (2018) emphasised technological and organisational environment as well as personality factors as being collective influencers towards the utilisation of e-books by students. Research investigations made on e-learning/ m-learning system usage intentions among students have successfully used frameworks like TAM (Al-Rahmi et al., 2019) and extended UTAUT model (Yu-Huei et al., 2019) to explore possible e-resource usage by users. Exercising the variables used in TAM, Joo et al. (2018) observed students' intent to utilise e-learning courses is significantly influenced by their satisfaction. Extending the research work towards usage of the digital library, Ikenwe et al. (2020) conducted study at University of Benin among the undergraduate students to explore their level of usage of e-resources at the library and found perceived ease of use positively influencing their level of usage of e-resources. While studying students' satisfaction levels with digital library use, Xu and Du (2019) utilised constructs from the ISS, TAM and Theory of Media Affinity and found that there exist similarities between students of undergraduate and postgraduate courses towards their satisfaction for digital library usage.

Digital library adoption and usage require adequate awareness and knowledge among students/scholars about these services. Mabera and Sadiku (2021) observed the altered information need and search behaviour of students at a Nigerian University and figured the lack of requisite infrastructure and information skills as reasons behind less usage of digital library services. At the same time factors like social influence, performance expectancy and information quality were observed exerting a strong impact on digital library adoption at private Malaysian universities (Moorthy et al., 2019). Further to digital library usage, researchers were also keen to know about the effect of digital library usage on the performance of users. Such a study conducted by Yan et al. (2017) showed that users' acceptance and use of the digital library for acquiring information has a significant and large impact on their perceived decision quality.

Few researchers have focused their studies on student's continuous usage intention towards digital library or e-resources. Joo and Choi (2016) studied graduate and undergraduate users' continuous intention to use an e-library at a US-based university, using the expectation-confirmation theory (ECT). They found that perceived confirmation and perceived usefulness playing significantly influencing role for continuance intention. Adapting the ECT with ISS framework into their study, Zhao et al. (2015) attempted to understand the continuance usage of mobile library applications among students, teachers and research scholars. The study outcome confirmed the critical influence of perceived usefulness and ISS variables comprising system, service and information quality on continuance intention towards mobile library app usage. Building upon these outcomes, Rafique et al. (2021) disclosed that students' education level influences their satisfaction towards continuous usage of mobile library applications. The

same set of theoretical foundations was used by Xu and Du (2018) to explore determinants of user satisfaction leading towards user loyalty for a digital library. They concluded that user satisfaction showed a significant influence on user loyalty towards the usage of the digital library. Consolidating TAM and ISS model, Tyagi et al. (2022) found perceived ease of use by learners and service and system quality of e-resources to be the main drivers of their continuous usage intention. Abdul Rahman and Mohezar (2020) reported perceived instrumental support, perceived usefulness and ease of use, perceived quality, users' expectation, satisfaction and net benefits as important influencers towards digital library continuous usage. As initially emphasised upon by Seddon and Kiew (1996), the construct of perceived usefulness seem to be appearing in majority of related studies in context of continuous usage of various forms of information systems, including digital learning systems, thus showcasing the capability of the construct in capturing success of the system in terms of its continuous usage by users. Hence this study aims to utilise perceived usefulness as a key construct to understand the continuous usage of digital library among post graduate students.

3 Theoretical framework

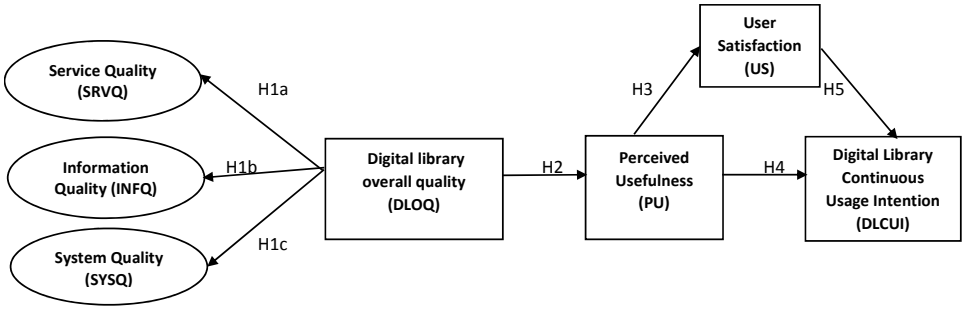
Past research involving evaluation of usage intention towards wide range of information system based services has successfully applied the ISS model, developed and modified by DeLone and McLean (2004) and Gao et al. (2015).

Like any other information system, the success of the digital library (reflected in users' continuous usage intention) can be significantly measured through its overall quality (Gorla et al., 2010). Therefore, this study takes its theoretical basis from the ISS model that facilitates to understand the effects of service quality, information quality and system quality components of overall quality of digital library on users' continuous usage intention. Likewise, the conceptual model of this study, based on the ISS framework, is presented in the next section.

4 Conceptual model and hypotheses formulation

This study suggests a conceptual model that is depicted in Figure 1 in accordance with the literature review.

Figure 1 Proposed conceptual model



4.1 Hypotheses formulation

Extant literature shows instances of strong influence exerted by different quality dimensions of information systems on their perceived usefulness in eyes of system users. For instance, Jiang (2011) and Benlian et al. (2011) found service quality to be exerting strong impact on the formation of perceived usefulness for electronic service systems and software-as-a-service respectively. Towards digital library resources, Tyagi et al. (2022) observed strong association between perceived usefulness and service quality among users of digital library resources on handheld devices. Saeed and Abdinnour-Helm (2018) emphasised users' belief towards the information aspect of information systems for conducting their performance that gets negatively affected by poor information quality, thus further adjusting their perception of its usefulness. The information dimension of quality has received remarkable support from extant literature in terms of its influence on users' perceived usefulness were found to important in the e-learning context (Cheng, 2020; Suzianti and Paramadini, 2021; Motaghian et al., 2013). Tyagi et al. (2022) established strong effect of information quality towards perceived usefulness among users for digital library resources on handheld devices. System quality assumes noteworthy importance while using information systems. It brings the desired assistance level for the user from the information system (Prasetyo et al., 2021). Studies on online learning platforms have suggested significantly positive impact of system quality on perceived usefulness (Chen et al., 2020; Alkhawaja et al., 2022; Rezvani et al., 2022) by users.

Additionally, prior research examined overall quality as a second order construct in terms of the service, information, and system quality dimensions of digital information systems (Cidral et al., 2018; Uppal et al., 2017). Al-Obthani and Ameen (2019) and Aldholay et al. (2018) specifically achieved high factor loadings for information quality, system quality, and service quality on the overall quality of digital information systems. Similar to that, this paper offers to look into the combined effects of all quality aspects of the digital library system (henceforth referred to as "digital library overall quality" or "DLOQ") on perceived usefulness in terms of the following assumptions. Along similar lines, this work proposes to investigate combined impact of all quality dimensions of the digital library system (henceforth referred to as digital library overall quality "DLOQ") on perceived usefulness in terms of the following hypotheses.

H1(*a*)*: Service quality constitutes a significant component of DLOQ.*

H1(*b*)*: Information quality constitutes a significant component of DLOQ.*

H1(*c*)*: System quality constitutes a significant component of DLOQ.*

H2: DLOQ exerts favourable influence on Perceived Usefulness of digital library.

Extant literature has shown positive and significant relationship of perceived usefulness with user satisfaction **(**Junjie, 2017; Alraimi et al., 2015). Nong et al. (2022) found a significant influence of Perceived Usefulness on User Satisfaction towards online MOOC learning platforms. Similar results were found in related studies on online learning systems (Chen et al., 2020) and learning management systems (Haddad, 2018). On similar lines, following hypothesis is being put forth.

H3: Perceived usefulness exerts favourable influence on user satisfaction for the digital library.

Perceived usefulness substantially impacts users' continued intention for using Massive Open Online Courses (Alraimi et al., 2015; Gao and Yang, 2016; Ouyang et al., 2017; Zhang et al., 2018), e-governance platforms (Jiang, 2011), e-learning systems (Alkhawaja et al., 2022) mobile applications towards e-library usage (Rezvani et al., 2022) and digital libraries (Khan and Qutab, 2016). Therefore, following hypothesis is being put forth.

H4: Perceived usefulness exerts favourable influence on digital library continuous usage intention (*DLCUI*).

User satisfaction derived from using digital information systems critically influences continuous intention to use it. Puriwat and Tripopsakul (2021) found substantial effect of user satisfaction on digital payment services acceptance during the recent pandemic times. Similarly, Rahmi et al. (2021) discovered distance education students' desire towards continuous usage of e-learning systems getting significantly impacted by their satisfaction. Further, user satisfaction emerged to be the eminently important factor affecting continuous intention for e-books usage among students, in a study by Liu et al. (2021). In a study on students' inclination towards digital academic library applications, Rafique et al. (2021) however observed a significant, though weak influence on the intention to continue usage by user satisfaction of students. Therefore, following hypothesis is being put forth.

H5: User satisfaction exerts favourable influence on digital library continuous usage intention (*DLCUI*).

4.2 Mediating role of user satisfaction

The extant literature has a long established measure to evaluate the information system usage through user satisfaction (Isaac et al., 2017). Chopra et al. (2019) assessed e-learning systems' efficacy through user satisfaction towards meeting student requirements. Multiple studies have significantly observed the mediating role of user satisfaction in varying contexts in e-learning (Azwar et al., 2021; Purnomo et al., 2022) leading to a learning outcome and benefits. Nugroho et al. (2019) confirmed full mediation by user satisfaction between continuous intention towards e-learning systems and perceived value among users. Pozón-López et al. (2020) observed the relationship between perceived usefulness and usage intention of students being completely mediated by user satisfaction in context of massive open online courses. Therefore, following hypothesis is being put forth.

H6: User satisfaction is the mediator between perceived usefulness and digital library continuous usage intention (*DLCUI*).

5 Research methodology

5.1 Research design

The cross-sectional survey-based research approach is used in this study. The structured questionnaire comprising of scale items on 5-point Likert scale (1-strongly disagree to

5-strongly agree) is employed as survey instrument. Responses obtained from the respondents were further analysed using SPSS- 17.0 and AMOS-21.0.

5.2 Questionnaire design

With the help of an in-depth review of existing literature, relevant variables and scale items were identified for adaptation. After small modifications under the guidance of academic experts and pilot testing, the modified scale items were incorporated into the final questionnaire.

The statements pertaining to original scale items were modified with the help of academic experts in area of e-learning, to extract the information in the given context. Three academic experts helped in subtly restructuring the statements for seeking responses from post graduate students, thus establishing the content validity of scale items. Thereafter, a pilot test was conducted among a small group of students pursuing their postgraduate studies at a private university located in Dehradun, the capital of state of Uttarakhand. The result analysis of pilot test produced Cronbach's alpha values surpassing 0.70 which confirmed the construct reliability of the questionnaire.

Table 1 presents the modified scale items and their respective sources.

Table 1 Scale items adapted in questionnaire

Variables	*Scale items*	*Source*
Perceived usefulness (PU)	Using the digital library improves my performance (PU1)	Saeed and Abdinnour-Helm (2008)
	Using the digital library improves my effectiveness (PU2)	
	Using the digital library enhances my productivity (PU3)	
User satisfaction (US)	I feel satisfied with the performance of the digital library (US1)	Liao et al. (2009)
	I feel happy with the usage experience of the digital library (US2)	
	I feel delighted with the usage experience of the digital library (US3)	
Digital library continuous usage intention (DLCUI)	I intend to continue using the digital library (DLCUI1)	Liao et al. (2009)
	I intend to continue using the digital library as against other options available (DLCUI2)	
	I would like to continue using the digital library to the fullest possible extent (DLCUI3)	
Information quality (INFQ)	I find relevant information available in the digital library (INFQ1)	Wang and Lin (2012)
	I find information available in an organised manner in the digital library (INFQ2)	
	The information content available in the digital library is all-inclusive (INFQ3)	
	The information available in the digital library is latest enough to meet my requirement (INFQ4)	

Table 1 Scale items adapted in questionnaire (continued)

Variables	*Scale items*	*Source*
System quality (SYSQ)	I find the digital library easy to use (SYSQ1)	Zhou (2011)
	I find the digital library adaptable to work with (SYSQ2)	
	The information available in the digital library is simple and clear (SYSQ3)	
	The response time on digital library is fast enough to do my work (SYSQ4)	
Service quality (SRVQ)	The digital library works under excellent quality environment (SRVQ1)	Pituch and Lee (2006)
	The service quality of digital library environment meets my expectations (SRVQ2)	
	The digital library environment facilitates fast service response (SRVQ3)	

In the next step, the data collection process for the main survey was initiated.

5.3 Data collection

The data collection process was conducted among students pursuing post-graduate studies at privately owned universities based in Uttarakhand state, which is swiftly emerging as an education hub in India. The majority of the private universities have been setup here within a decade and have progressed towards the adoption of digital learning systems (ANI, 2020). An invitation request was sent to each of the 21 private universities. The permission was received from 18 universities, allowing visit to their campus for data collection. Further, with help of stratified random sampling, 30 students from the last year of postgraduation courses were identified at each university for data collection. It has been observed that students in their post-graduation studies use the digital library more frequently than students in graduation studies (Xu and Du, 2019) and have substantial experience in digital library usage (Dahan-Oliel et al., 2016; Zhao et al., 2015). Hence, the pre-condition of a minimum of 3 months of usage experience for the digital library was taken into consideration. A total of 540 responses were obtained. After removing 9 questionnaires due to the presence of outliers, identified through Mahalanobis distance, finally, 531 questionnaires were proceeded with for further analysis, which qualifies for the minimum size needed to use SEM (Hair et al., 2016). The calculated mean values replaced the missing data and common method bias was not detected as observed during Harman's one-factor test.

6 Data analysis

6.1 Demographics

Table 2 represents the demographic and usage characteristics of responding students.

Table 2 Demographic details

Characteristics	*Value*	*Count*	*Percentage*
Gender	Male	273	51.41
	Female	258	48.59
Age	21–23 Years	109	20.53
	24–26 Years	270	50.85
	27–30 Years	112	21.09
	Above 30 Years	40	7.53
Usage frequency	Once per week	223	42
	Two to three days per week	170	32
	Four to five days per week	138	26

6.2 Exploratory factor analysis (EFA)

EFA is performed to extract the simplest possible structure from the dataset collected. Corresponding results are depicted in Table 3.

Table 3 Rotated component matrix

	Components					
	i	*ii*	*iii*	*iv*	*v*	*vi*
SRVQ1						0.787
SRVQ2						0.782
SRVQ3						0.746
INFQ1	0.752					
INFQ2	0.803					
INFQ3	0.752					
INFQ4	0.717					
SYSQ1			0.799			
SYSQ2			0.808			
SYSQ3			0.820			
SYSQ4			0.571			
PU1					0.794	
PU2					0.853	
PU3					0.746	
US1				0.845		
US2				0.928		
US3				0.871		

Table 3 Rotated component matrix (continued)

	Components					
	i	*ii*	*iii*	*iv*	*v*	*vi*
DLCUI1		0.908				
DLCUI2		0.925				
DLCUI3		0.911				
Total variance explained (Cumulative %)	14.203	27.931	41.474	54.089	65.054	75.617

Extraction method: Principal component analysis.

Rotation method: Varimax with Kaiser normalisation.

a. Rotation converged in 6 iterations.

6.3 Confirmatory factor analysis

The model validity and reliability are examined through Confirmatory factor analysis. The values of absolute fit indices, i.e., χ^2/df, RMR, GFI, AGFI were obtained at 2.257, 0.031, 0.933 and 0.909 respectively. Whereas the relative fit indices (NFI, PNFI, IFI, TLI) were obtained at 0.94, 0.767, 0.966, 0.958 and non-centrality based indices (CFI, PGFI, RMSEA) were obtained at 0.965, 0.689, 0.051 respectively. The values obtained suggest that all the fitness indices exceed the minimum required limits (Hooper, 2008) excluding the chi-square p-value, having less value than the recommended limit. This could be the result of the sample size taken for the study which is larger than 200 (Bentler and Bonett, 1980). The rest of the values grant acceptance to our model.

6.4 Validity (Convergent and discriminant) and reliability

The summary of validity (Convergent and Discriminant) and Reliability results are shown in Tables 4 and 5.

Table 4 Reliability and convergent validity

Construct	*Scale items*	*Factor loadings* *(>0.5)*	*Composite reliability* *(>0.7)*	*AVE* *(>0.5)*	*MSV* *(<AVE)*
INFQ	INFQ1	0.697	0.83	0.565	0.438
	INFQ2	0.773			
	INFQ3	0.843			
	INFQ4	0.683			
SYSQ	SYSQ1	0.733	0.854	0.597	0.438
	SYSQ2	0.858			
	SYSQ3	0.829			
	SYSQ4	0.654			

Table 4 Reliability and convergent validity (continued)

Construct	*Scale items*	*Factor loadings (>0.5)*	*Composite reliability (>0.7)*	*AVE (>0.5)*	*MSV (<AVE)*
SRVQ	SRVQ1	0.668	0.782	0.546	0.393
	SRVQ2	0.778			
	SRVQ3	0.767			
US	US1	0.773	0.900	0.750	0.229
	US2	0.903			
	US3	0.915			
DLCUI	DLCUI1	0.919	0.949	0.862	0.229
	DLCUI2	0.957			
	DLCUI3	0.909			
PU	PU1	0.722	0.819	0.601	0.317
	PU2	0.801			
	PU3	0.798			

Table 5 Discriminant validity

	PU	*SRVQ*	*INFQ*	*SYSQ*	*DLCUI*	*US*
PU	**0.776**					
SRVQ	0.443	**0.739**				
INFQ	0.544	0.627	**0.752**			
SYSQ	0.563	0.560	0.662	**0.773**		
DLCUI	0.251	0.233	0.217	0.221	**0.929**	
US	0.187	0.077	0.044	0.079	0.479	**0.866**

6.5 Measurement model

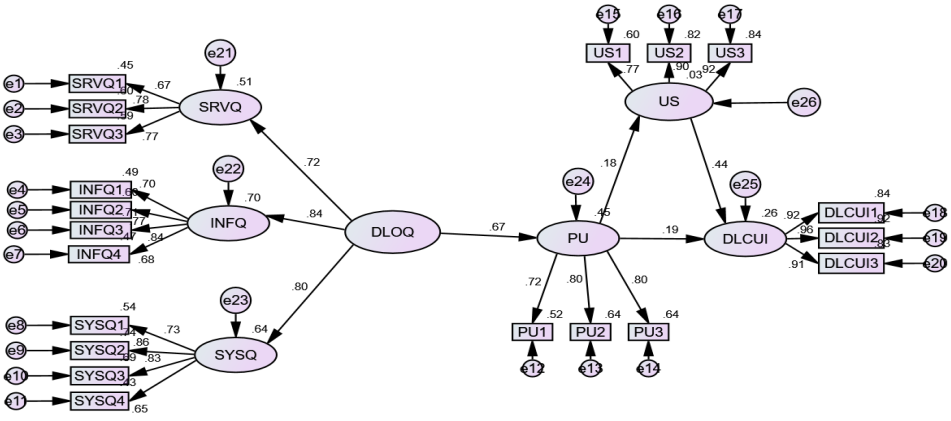
After establishing the validity and reliability parameters, the estimation of regression weights of relationships is done as exhibited in the model shown in Figure 2.

7 Results and discussion

The structural model analysis indicates a significant relationship between digital library overall quality (DLOQ) with service quality ($\beta = 0.717$, $p < 0.000$), information quality ($\beta = 0.838$, $p < 0.000$) and system quality ($\beta = 0.8$, $p < 0.000$), suggesting these to be significant dimensions of DLOQ and establishing hypotheses H1(a), H1(b), H1(c). Information quality was found to be the strongest contributor of DLOQ. In previous studies, information quality is evaluated by relevance, accuracy, completeness and appropriate format as a reflection of the quality of the output (Chiu and Wang, 2008; Chiu et al., 2005). The service quality is measured with reference to the prior expectation of users as well as the actual functionality of the digital library, which contributes

strongly and significantly to the formation of the DLOQ, coinciding along with the preceding researches (Chopra et al., 2019; Grönroos, 1984; Koohang and Du Plessis, 2004). DLOQ is significantly predicted by the system quality, which was measured in terms of accessibility, flexibility, speed, and arrangement of information. The significant contribution of system quality to DLOQ is observed and established in earlier studies (Ozkan and Koseler, 2009; Zheng et al., 2013).

Figure 2 Structural framework (see online version for colours)



Further, the DLOQ significantly influences perceived usefulness ($\beta = 0.668$, $p < 0.000$), which further influences users' satisfaction ($\beta = 0.181$, $p < 0.000$) and their continuous usage intention ($\beta = 0.188$, $p < 0.000$), validating the hypotheses H2, H3 and H4 respectively. Effect of DLOQ on perceived usefulness finds support from previous researches like Alsabawy et al. (2016) and Machdar (2016), who suggested that perceived usefulness of an information system is significantly caused by its quality dimensions experienced by users. Though Saeed and Abdinnour-Helm (2008) observed the additional effect of system integration on perceived usefulness, its degree of impact was less than that of the quality dimension. Formation of perceived usefulness due to the presence of Overall quality of digital library generates satisfaction among users and drives them to further use the digital library. Thus, we subsequently observe the significant effect of perceived usefulness on user satisfaction and DLCUI, making it a key construct into formation of DLCUI, as supported in the previous literature on digital learning systems (Huang, 2021; Saeed Al-Maroof et al., 2020). User satisfaction is also found to be exerting significant influence on DLCUI ($\beta = 0.444$, $p < 0.000$), which is in line with the outcome of previous findings (Aldholay et al., 2018; Tam and Oliveira, 2016), thus validating hypothesis H5. The results of testing of hypotheses H1–H5 are presented in Table 6.

Additionally, this study validates the mediating influence of user satisfaction, establishing the proposed hypotheses H6. The mediation effect of user satisfaction was tested through bootstrapping method (Song et al., 2013; Kio and Lau, 2017) and results are presented in Table 7. It suggests that user satisfaction partially mediates the relationship between perceived usefulness and DLCUI. The partial mediating influence of user satisfaction finds support from extant literature, wherein it has shown to be playing significant partial mediating role under the setup of information system based

services (Kamboj et al., 2022; Pozón-López et al., 2020). The results state that perceived usefulness exerts 26.8% variation on DLCUI in presence of user satisfaction, which reduces to 7% in its absence. It means that user satisfaction strongly facilitates the relationship between perceived usefulness and DLCUI and hence is an important factor for the perceived usefulness and DLCUI relationship.

Table 6 Hypothesis testing results

Hypothesis			*Estimate*	*S.E.*	*C.R.*	*P-value*	*Approved/Disapproved*
H1(a):	Service quality constitutes a significant component of DLOQ						
	SRVQ	←DLOQ	0.717	0.106	9.371	***	Approved
H1(b):	Information quality constitutes a significant component of DLOQ						
	INFQ	←DLOQ	0.838	0.129	9.626	***	Approved
H1(c):	System quality constitutes a significant component of DLOQ						
	SYSQ	←DLOQ	0.8	0.107	9.371	***	Approved
H2:	DLOQ exerts favourable influence on Perceived Usefulness of digital library						
	PU	←DLOQ	0.668	0.088	8.894	***	Approved
H3:	Perceived usefulness exerts favourable influence on user satisfaction for the digital library						
	US	←PU	0.181	0.063	3.423	***	Approved
H4:	Perceived Usefulness exerts favourable influence on digital library continuous usage intention						
	DLCUI	←PU	0.188	0.079	4.005	***	Approved
H5:	User satisfaction exerts favourable influence on digital library continuous usage intention.						
	DLCUI	←US	0.444	0.068	9.314	***	Approved

***Significant at 99%.

Table 7 Mediation analysis

Effect type	*Standardised beta*	*p-value*	*Remark*	*Result*
Total effect	0.268	0.009	Total effect is significant	
Indirect effect	0.08	0.003	Indirect effect is significant	Partial Mediation (H6 approved)
Direct effect	0.19	0.012	Direct effect is significant	

As discussed above, the results indicate that variation in DLCUI is significantly explained by the factors considered in this study, however the unexplained portion in the variation does exist. The discussions in existing literature on use of e-learning systems indicate towards certain critical factors like subjective norms, perceived ease of use, computer self-efficacy and enjoyment (Al-Emran et al., 2020; Dalvi-Esfahani et al., 2020; Lew et al., 2019) that drive the post-graduation pursuing students' continuous intention to use these systems. Notably, such students are exposed to peer learning environment and their subjective norms influence their intentions, efforts and decisions. Furthermore, the students' ability to understand and navigate through the digital environment also affects their ease of use and motivate them towards continuous usage. The fun element in learning on the yet unexplored digital platform also affects their

intention. Thus, this study could confidently conclude about the effect of different factors discussed in the e-learning literature, specifically those mentioned above and their contribution to the description of unexplained variation in DLCUI among the students.

8 Conclusion

With the help of ISS model, this study presents certain key constituents that are helpful in enhancing the continuous usage intention towards digital library among students. The quality components of digital library are established as an important originating point in this context. The students, benefitted by quality aspects of digital library system realise the usefulness of digital library that aids to their academic pursuits. Generation of perceived usefulness among the students thus assumes a critical role at this juncture. The presence of user satisfaction further fosters the relationship between perceived usefulness and continuous usage intention. These findings provide for greater emphasis on facilitation of digital library quality parameters at HEIs. These quality aspects, resulting in perceived usefulness, pave the way for enhanced usage intention in presence of students' satisfaction.

9 Recommendations to stakeholders

For the purpose of increasing students' continuous intentions toward the digital library, the stakeholder is given the following recommendations.

- *Higher education institutions*

Higher education institutions should prioritise the acquisition of diverse and high-quality electronic resources, including books, reports, research papers, and periodicals, to enrich the digital library. To ensure continuous improvement, they should regularly assess the allocated budget for digital library enhancement. Emphasis should be placed on updating both physical and digital infrastructure to maintain a high-quality digital library. Strategies include fostering partnerships with publishers, negotiating affordable subscription packages, and allocating specific funds for digital library development. For instance, a HEI could establish partnerships with leading academic publishers to negotiate special subscription packages. An example could be collaborating with a scientific publisher to provide access to a collection of research journals and databases relevant to STEM fields at a discounted rate, thus enriching the digital library's resources.

- *Academic librarians*

Librarians can enhance digital library quality by engaging in continuous software and system upgrades. They should actively seek student feedback to understand their needs and preferences, enabling the customisation of library services. Establishing more interactive sessions, workshops, and one-on-one guidance for navigating digital resources would significantly enhance user satisfaction. Academic librarians should aim to create user-centric services by adopting innovative technologies that facilitate easy access, searchability, and usability of digital resources. For example, Librarians can implement

user feedback mechanisms such as suggestion boxes or online surveys to gather insights into students' preferences. For example, they could conduct focus group discussions to understand specific areas where students struggle in navigating the digital library and then create tutorial videos or conduct workshops tailored to address those challenges.

- *Teachers*

Educators play a crucial role in promoting digital library usage among students. By incorporating digital library resources into course assignments, teachers can encourage students to explore and utilise the available materials. Implementing mandatory digital library sessions alongside traditional classroom sessions, perhaps by integrating digital library usage into the curriculum or syllabus, will reinforce students' interactions with the digital library system. Additionally, providing guidance on how to effectively use specific resources within the digital library for academic purposes would be beneficial. For instance, an English literature professor might assign a research paper that requires students to use specific digital resources available only through the institution's library portal. The assignment could include instructions on how to navigate and cite the resources, encouraging students to explore and utilise the digital library's offerings for academic purposes.

- *Service provider companies for digital library*

Service provider companies can contribute by offering tailored and attractive digital library services designed specifically for HEIs. Collaboration between these companies and educational institutions could lead to customised services aligned with various academic programs and specialisations. Additionally, providing off-campus access and special subscriptions for educators could encourage increased usage beyond institutional premises. These companies should focus on user-friendly interfaces, comprehensive search functionalities, and technical support to enhance the overall user experience. A digital library service provider could customise its interface and search functionalities for various disciplines. For example, they could tailor a specialised interface for medical students, incorporating features that allow easy access to medical journals, databases, and interactive learning modules relevant to their field.

- *Government regulatory authorities*

Governments can support digital libraries in HEIs by allocating dedicated funds for their development. Public-private partnerships can be established to facilitate the installation and maintenance of state-of-the-art digital library systems. By reducing the financial burden on institutions, these partnerships enable the implementation of cutting-edge technology and resources within digital libraries. Furthermore, governments should create policies that encourage collaboration between educational institutions and digital library service providers, fostering an environment conducive to technological advancement and accessibility. A government initiative could involve providing grants to HEIs to upgrade their digital infrastructure. For instance, a government-funded program could support the installation of high-speed internet connections across campuses, enabling seamless access to digital libraries for students and faculty. This would reduce the financial burden on institutions and improve overall accessibility to digital resources.

10 Policy recommendations

1 *Strategic collaboration with IT companies*

The new education policy in India aims to leverage digital technology to enhance various facets of higher education. To promote the effective utilisation of digital libraries, there should be a deliberate effort to foster partnerships between HEIs and IT companies. These collaborations can focus on developing tailored solutions that align with the diverse educational programs and specialisations offered by institutions. For instance, IT companies can work closely with universities to design user-friendly interfaces, specialised search algorithms, and interactive learning tools within digital library platforms that cater to specific academic disciplines or levels of study (diploma, undergraduate, postgraduate, doctoral).

2 *Customised solutions for educational programs*

Emphasising the importance of customised solutions, IT companies should be encouraged to design digital library platforms that cater to the unique requirements of various educational programs. For instance, a collaboration between a software company and a law school could result in the development of a digital library platform equipped with legal databases, case studies, and resources specifically curated for law students. Similarly, such tailored solutions could be extended to other fields like engineering, medicine, humanities, etc., ensuring that the digital library resources are highly relevant and beneficial to each discipline.

3 *Government support through financial allocation*

The government's role is pivotal in supporting HEIs in their journey towards establishing and maintaining high-quality digital libraries. Allocation of funds specifically earmarked for digital library infrastructure would significantly alleviate the financial burden on institutions. This funding can cover various aspects, including hardware, software licenses, digital content acquisition, and the implementation of robust technological infrastructure. By investing in these areas, the government can facilitate the seamless integration and widespread usage of digital libraries across educational institutions nationwide.

4 *Encouraging innovation and accessibility*

The policy should encourage innovation within digital libraries, incentivising the development of advanced features such as AI-driven search capabilities, virtual reality-enabled learning experiences, and collaborative platforms for knowledge sharing. Furthermore, initiatives should be taken to ensure accessibility to digital library resources, especially for remote and underserved areas. This could involve initiatives to provide internet connectivity, access to devices, and training programs to facilitate effective utilisation of digital resources among all students and educators.

5 *Monitoring and evaluation mechanisms*

Implementation of mechanisms to monitor and evaluate the effectiveness of digital libraries within HEIs is crucial. The policy should outline frameworks for assessing the

usage, impact, and user satisfaction levels regularly. This evaluation will enable iterative improvements and ensure that digital libraries remain aligned with evolving educational needs and technological advancements.

11 Limitations

The use of cross-sectional data poses limitations in capturing the dynamics of respondents' reactions over time. While the study ensured a minimum of 3 months of digital library usage experience among respondents, there remains the potential for bias inherent in self-reported data. Despite a high response rate of over 90%, acknowledging this limitation emphasises the need for future longitudinal studies to better assess the evolving nature of user experiences and perceptions regarding digital libraries. Additionally, focusing solely on privately owned universities in Uttarakhand, India, could restrict the generalisability of findings to other regions or institution types. Recognising the limitations of generalisability, this study's findings may reflect the unique characteristics and dynamics within Uttarakhand, India. Factors specific to this region, such as cultural nuances, educational infrastructure, or economic variations, might have influenced respondents' perceptions and behaviours toward digital library usage. Discussing these regional influences provides valuable insights into the potential variations that might exist in different geographic contexts, thereby contributing to a more comprehensive understanding of digital library adoption in diverse settings.

12 Future research directions

Future research should consider expanding the sample beyond privately owned universities in Uttarakhand. Including diverse institution types and a larger, more diverse sample size from multiple regions of India would enable comparative analyses. This approach could provide insights into how factors such as institutional ownership, geographical location, and cultural diversity influence digital library usage patterns. Researchers could delve into exploring digital library usage among various user groups, such as faculty members, different academic disciplines, or students with varying levels of digital literacy. Additionally, investigating the impact of different digital library platforms, interface designs, and content curation strategies on user satisfaction and continuous usage could be valuable for optimising user experiences. Understanding how cultural nuances influence the adoption and utilisation of digital libraries is a promising area for future research. Comparative studies across regions with diverse cultural backgrounds within India or across countries can shed light on how cultural factors shape attitudes, behaviours, and preferences regarding digital library usage.

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