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User Satisfactions on Digital Library: A Correlational Study

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Abstract. Academic Digital Library (DL) is an online system providing access to a wide variety of academic content and services. It is designated to help students to access digital resources to fulfill their academic needs as an alternative to printed library materials through network environment. Covid19 pandemic has in large affecting and restricting teaching and learning activities on premises thus making it to be done through online. DL as an enablement system, is capable of channelling its benefits to students to get access and retrieve relevant academic resources digitally. The aim of this paper is to investigate the effectiveness of the academic DL in fulfilling students' needs by correlating their satisfaction through usage experience with the following predictors; perceived of use, perceived usefulness, system quality, service quality and digital library collection. A quantitative study is opted by surveying 200 students of public university in Selangor. The study findings indicate that all of the posited determinants possess highly significant positive relationships with students' satisfaction, ranging from r = 0.45 (the lowest) to r = 0.70 (the highest). Nevertheless, a serious multicollinearity issue is expected to arise in modelling part as most predictors are correlated to each other. It could lead to unreliable and unstable estimates of linear generalized regression coefficients. Thus, these bivariate relationships results serve as basis towards a larger scope of research to embark on structural path model rather than using generalized model to avoid the variance of model's coefficient inflated due to linear dependence with other predictors when modelling this relationship.
Keywords: Digital Library, Satisfaction, Effectiveness, Correlation

1 Introduction

Digital Library (DL) has been introduced since the year of 1990s in many organizations especially in the higher education institutions in developing countries

all over the world. Explosion in information management and information system technology have brought dramatic changes in learning and library system environments. Through the passage from physical library to DL era, the use of academic digital library systems does witness the spectacular impact on academic societies' way of performing their study (Razilan et al., 2015). Li, Jiao, Zhang and Xu (2019) outlined that many benefits can be gained from using DL by effectively utilizing resources provided.

The growth of DL in institutions especially in higher education is developing rapidly. Academic DL is an online system providing access to a wide variety of academic content and services. It is designated to help students to access digital resources to fulfill their academic needs as an alternative to printed library materials through network environment. In fact, in more recent years, studies on the development of information systems in higher education have been focussing on developing systems to support learning (Mortono et.al, 2020). Due to this, physical resources are receiving less attention and might be becoming less convenient as students tend to use electronic resources. This setting is seen as more convenient and easier with respect to information retrieval during the pandemic period compared to physical resources. The government's Movement Control Order (MCO) as impact from Covid19 pandemic, has in large affecting and restricting teaching and learning activities on premises. However, with the existence of digital library making its way as an enablement system of an institution to take over the so-called physical routines where the benefits are channelled to students to get access and retrieve relevant information for academic purposes. Moreover, references from DL will enable students in accomplishing assignments via easy access; cost and money saving and as well as providing a variety of choices of electronic databases.

The purpose and the main focus of this paper centres on leveraging DL usage anchored by the determinants of the effectiveness of digital library towards students' satisfaction. To achieve effective academic activities, it is expected that students access and use electronic information resources especially the ones subscribed by the higher institution. In this context, this study is aimed to identify the bivariate relationships of the study determinants in understanding the DL usage behaviour. Many researchers for e.g., Rose et al. (2004); Mathieu and Taylor (2006) and Baron and Kenny (1986) emphasized on requiring the total-effect model test for establishing any mediation effect model such as Partial Least Squares (PLS). The finding of the study would be elaborated to opt the best model to investigate the effectiveness of academic DL provided by the university.

2 Literature Review

This study proposed with the intention to investigate the effectiveness of DL with respect to the following determinants: perceived ease of use, perceived usefulness, information quality, system quality and also digital library collection in order to obtain students' satisfaction. Literature review has shown mixed understanding on the differing level of awareness, perception, acceptance and use by various respondents (Omotayo & Haliru, 2020). Omotayo & Haliru (2020) also emphasized that different

user groups have differing expectations in the use of DL services as well as various motivations and factors influencing use and non-use of DLs were also identified from literature. According to Mortono, Nurkhin, Mukhibad and Anisyukrillah (2020), higher education management must be adaptable to information technology by developing internet-based information systems in all existing fields.

Students' satisfaction

The satisfaction of user (in this context is referring to the students) has been proven by Xu & Du (2018) where user satisfaction can help in enhancing the user's loyalty or desire in using digital library and it has also improved the user's knowledge in the digital library domain. Satisfaction implies that one has reached his expectations on something or pleasure received from others. Similarly, students might be potentially using the digital library in a more frequent manner if its performance meets their expectations. According to Xie et al. (2019), a careful examination of the DL interaction experiences affords a deep understanding of their help-seeking situations in their information search process. Moreover, increasing user satisfaction with digital library may have implications including recommending the digital library to others, the digital library reusing as well as the digital library engaging and integrating with them. It should be noted that system quality, service quality, and information quality are important factors in the formation of perceived usefulness, perceived ease of use, and digital libraries' affinity (Soltani-Nejad, Taheri-Azad, Zarei-Maram and Saberi, 2020).

Perceived ease of use

Perceived ease of use can be defined as the performance of the particular system has making the usage of the user become effortless (Davis, 1989). Perceived ease of use is defined as accessibility of the digital library platform where it plays as one of crucial factors relating to user's first impression towards the digital library. Ogunrewo, Kolawole and Osundina (2015) found that exists a significant effect on perceived usefulness of electronic databases. Eiriemiokhale & Idowu (2021) claim that perceived ease of use and perceived usefulness are both strong determinant of electronic database usage. Following to this claim, it may not be wrong to imply that it could lead to the creation of positive / negative and favourable / unfavourable attitudes toward using it.

Perceived usefulness

Perceived usefulness is defined as when user of the digital library platform feels or thinks that the existence of that service can help them in improving their academic performance (Davis, 1989). Many researchers claimed that user acceptance of digital library can be measured based on the perceived usefulness by the user (Hong et al., 2002; Thong et al., 2002; Lee et al., 2005; Ramayah, 2006; Yusoff et al., 2009; Jeong, 2011). Nevertheless, there were also studies indicated that perceived usefulness is one of the key factors of satisfaction (Roca et al., 2006; Lwoga, 2014).

Information quality

Information quality can be defined as the output or outcome that has been provided by the DL, in which measuring the degree of information needs by the user. Online library resources like academic DL should provide a wealth of information that meets students' needs. Study done by Razilan (2012) on the DL Success model, his findings showed the statistical evidence of information quality dimension that having high impact on the success of digital libraries through DL usage for Information Provisioning (DLUIP) indicators. It indicates that the content breadth has the strongest influence towards individual usage on DL. The way to measure the good information quality is by looking at the relevancy, accuracy, authenticity, scope and understandability provided by the digital library platform (Sagar, 2006). According to Roca et al. (2006); Freeze et al. (2010) and Ramayah and Lee, (2012), the satisfaction of online learning system is when it reached the best quality of information.

System quality

Apart from the factors mentioned earlier system quality is also one of the determinants investigated in this study. System quality is mostly focusing on the system's performance of a digital library platform. If the quality of the system is bad, it might impact user satisfaction. The system quality of a DL is considered to be a vital dimension for evaluating the success of a digital library in the DL Success model (Razilan, 2012). In his research, it is found that the system quality determinant has the highest impact through the PLS path model developed for DL Success model. Even it is also proven by the Information System model that system quality gives a big impact on the user satisfaction. Not only on focusing on the system's performance, system quality also to measure the interface or navigation of the digital library whether the interface is understandable or navigate the user. According to Sagar (2006), system quality also evaluates the information processing system to give the best experience for the user.

Service quality

Service quality can be determined by the way it is performing in terms of receiving, retrieving and delivering the information by the user as requested (Balog, 2011). A study by Razilan et al. (2016) on user satisfaction in using online resources provided by National Library of Malaysia, the finding shows that both service quality and system quality has the strongest correlation with user satisfaction. Samadi et al. (2014) state that the attributes that can be measures from service quality are amongst the accessibility, reliability, processing and also responsiveness.

Digital Library collection

As for digital library collection, it is referring to the collection of library resources provided in the digital library, which is focusing on the digital collection that only available on the selected public university. The usefulness of this collection towards

students is mainly to support their academic and so forth their usage behaviour of this digital collection can be measured using Information Search Process (ISP) model by Kuhlthau (2004, 2008). It identifies the three characteristics of user experience via affective (feelings), the cognitive (thoughts) and also the physical (actions) when using the digital library collection.

Table 1 indicates the analysis of review from the past works of the related research. Throughout the two decades from 1989-2020, it is clearly seen that the past researches had given more attention to the aspect of perceived usefulness as compared to other determinants.

Table 1. Review on the related past works.

Authors	Perceived Ease of Use	Perceived Usefulness	Information Quality	Service Quality	System Quality	Digital Library Collection
Soltani-Nejad et.al (2020)	✓	✓	✓	✓	✓	
Samadi et al. (2014)				✓		
Razilan (2012, 2016)			✓	✓	✓	
Lwoga, (2013)		✓				
Ramayah and Lee, (2012)			✓			
Jeong (2011)	✓	✓				
Freeze et al. (2010)			✓			
Masrek et al. (2016)			✓	✓		
Yusoff et al. (2009)		✓				
Ramayah (2006)		✓				
Roca et al. (2006)		✓	✓			
Sagar (2006)			✓		✓	
Lee at al. (2005)		✓				
Kulthau (2004, 2008)						✓
Hong et al. (2002)		✓				
Thong et al. (2002)		✓				
Davis (1989)	✓	✓				

Past works on investigating the effectiveness of DL had guided the authors to design the direct effects model via the following model framework as shown in Figure 1.

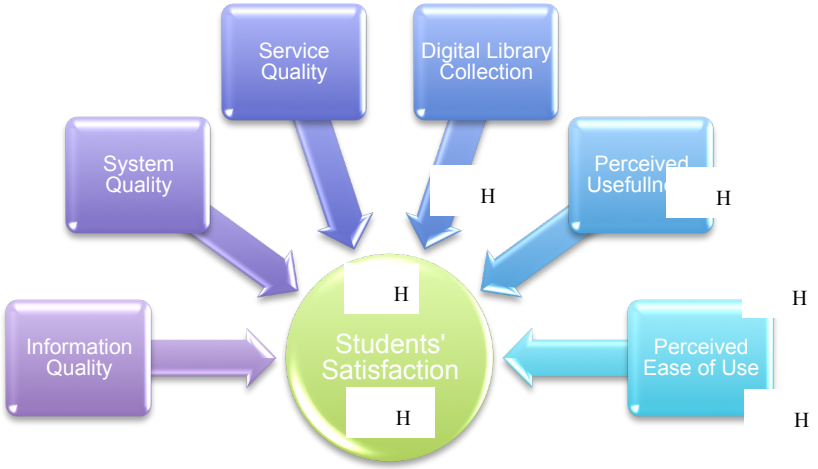

Fig. 1. Research framework of the posited direct effects towards students' satisfactions

In Figure 1 the proposed research framework based on the discussion in the literature reviews is presented. Guided by the outcome from the model's framework analysis of the past studies (in Table 1), the authors proposed the following determinants of influencing the students' satisfaction of using academic DL. The hypotheses generated are as follow:

H_1: There is a significant positive relationship between Information Quality and Students' Satisfaction.

H_2: There is a significant positive relationship between System Quality and Students' Satisfaction.

H_3: There is a significant positive relationship between DL Collection and Students' Satisfaction.

H_4: There is a significant positive relationship between Service Quality and Students' Satisfaction.

H_5: There is a significant positive relationship between Perceived Usefulness and Students' Satisfaction.

H_6: There is a significant positive relationship between Perceived Ease of Use and Students' Satisfaction.

3 Methodology

This study opts quantitative survey of 200 students from the population of the postgraduate and undergraduate students of one of the public universities in Selangor. The questionnaires were distributed to students towards then end of the year 2020.

Many of theories established are related with the technology adoption and deployment under the information science field. Thus, this study model is conceptualized based on the models developed by Davis (1989), Delone & McLean (1992, 2002), Kulthau (2004); Jeng (2005), Razilan (2012) and Masrek & Gaskin (2016). Most of these frameworks are established with accordance to Information System Success Model (ISSM) and under the digital library domain. In Figure 1, information quality, system quality and digital library collection are three determinants hypothesized to influence each of perceived of use and perceived usefulness and so forth would impact students' satisfaction towards using academic DL.

In view of observing the relationships between response variable and predictors, it may be achieved using *indirect-effect* or *total-effect* (direct-effect) model. These types of causal model is as depicted in Figure 2 where the relationships between X→Y may be presented using two ways. Firstly, X→M and M→Y, as presented by paths *a* and *b* respectively, indicates the mediational effect (M) is injected in the relationships between X→Y (through M) with path *c,* and it is called an *indirect-effect* model. Secondly, the total-effect model of X→Y indicates the direct effect of X on Y through path *c'*. Prior to selecting between total-effect or indirect-effect model, this paper is focussing on observing bivariate relationship to gain deeper understanding on association between satisfaction and the selected predictors.

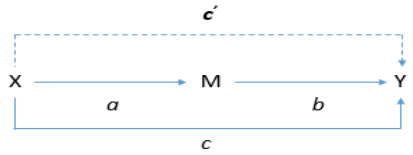

Fig. 2. Indirect (c) and Direct (c´) effect model

4 Results and Discussion

This section presents the findings of analyses on the study data where all of the analytics were done via *RStudio* package version 1.4.1717 (R Studio Team, 2021). *R* is an open source software package to perform statistical analysis and modelling (R Core Team, 2021). Apart from providing a wide variety of statistical, machine learning models, graphical techniques, it is also highly extensible and has extended function for visualization. It has a very wide community support and a large and user community who are adding new packages almost every day. *R* libraries used in this study are *Hmisc* - for correlation (Harrell Jr., 2021), *dplyr* - for data cleaning and transformation (Wickham et al. 2021), *ggplot2* - for graphical presentation (Wickham, 2016) and *gridExtra* - for generating comparison plots (Auguie 2017).

Respondents' Profiles

This section provides more visibility of the 200 respondents profiles in regards to their demographic information gathered from the survey.

Gender, age, education level & semester

In Table 2, 62% of the respondents are female and majority of them (about 96%) are 30 years old and below. The age distribution is skewed towards 20-24 years (50%) and 25-30 years (46) categories which potraying the common ages of first degree students in Malaysia.

This summary also provides the current semester of respondents involved in the survey where majority are respondents in their 3rd semester (35%). The rests of the semester's levels are approximately evenly distributed, ranging from 8.5% to 13.5% (semester 6 includes *others* category which indicates >6 semester).

As in line with the age of respondent's distribution, Table 2 also shows that majority of the respondents are composed of bachelor degree students (43%) followed by Master degree students (33%).

Table 2. Summary of respondents' profiles

Profile	**%**	**Profile**	**%**	**Profile**	**%**
Gender		*Semester*		*Education level*	
Female	62	1	8.5	Diploma	23
Male	38	2	10	Degree	43
Age (years)		3	35	Master	33
20-24	49.5	4	13.5	PhD	1
25-30	46	5	10.5		
30-34	4	≥ 6	22.5		
35-40	1				

Insight of Students' Profiles

Figure 3 exhibits a set of 3 plots produced using *ggplot2* package in R. The first plot shows the distribution of gender is skewed to 3rd, 4th and 7th semester. It clearly indicates the higher proportion of female in every semester due to higher number female respondents participated in the study.

The second plot displays the total of education level diploma and master levels students are the highest at 3rd and 4th semesters. Moreover, the participations of degree level students are more towards nearing to end of their study year. This gives a better representation of respondents' satisfaction level because they have gathered experiences using DL in their previous semesters, as compared to 1st semester students. Also, this may not be applicable to diploma degree level students because they have extended their studies from their first degrees and basically had been experiencing using DL through their study journey to get their bachelor degrees. Commonly, a diploma / master degree is less than 3 years programme but this survey

indicates that some students are extending their studies to 7th semester (which predominantly from degree students).

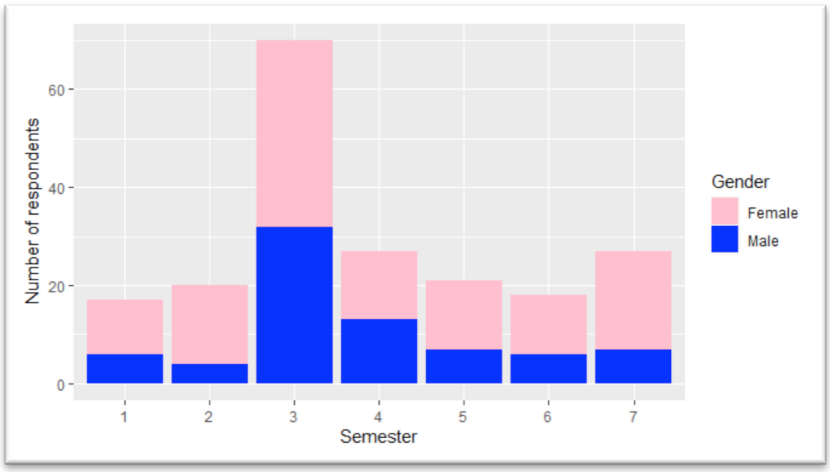

Fig. 3. First plot

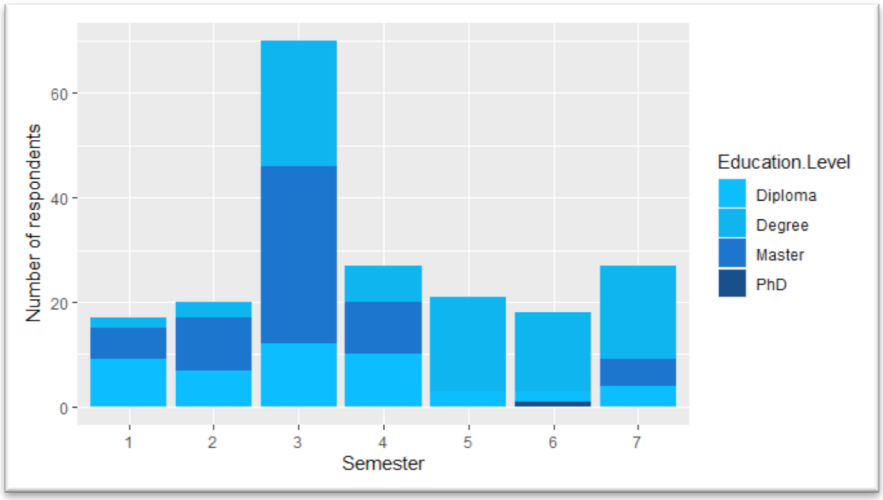

Fig. 4. Second plot

The last plot shows that basically female students are more than male students. However, for both gender, proportion to pursue study after 30 years old dropped significantly. Age category of ≥30 years shows only male students where this corresponds to women entering into marriage age with bigger child bearing and

caring responsibilities that hinders most of them to continue their study at higher levels.

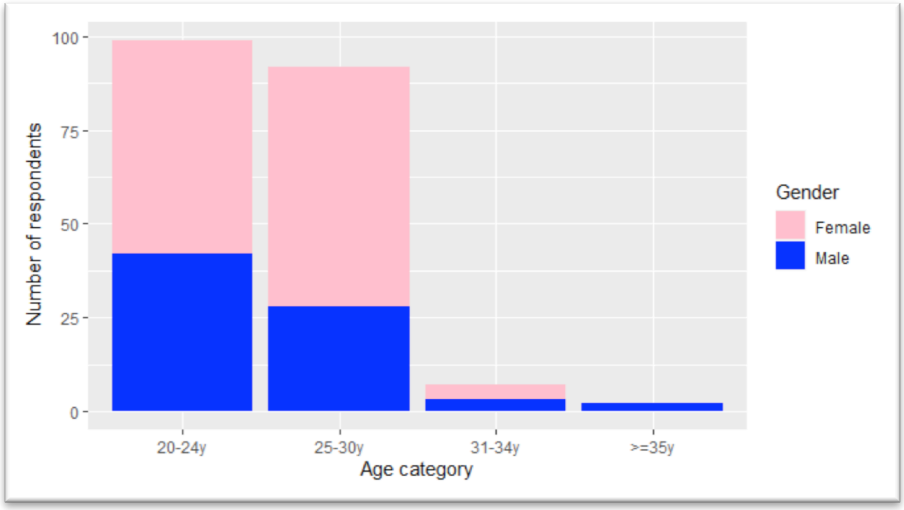

Fig. 5. Cross-tabulation plots of respondents' basic profiles

Descriptive analysis of study variables

The following section describes study findings from the selected analyses.

Reliability analysis

Reliability of the study survey's measurement items is measured by Cronbach alpha. It provides an estimate of the internal consistency of the test however it does not indicate the stability or consistency of the test over time. Hence, for this one-time survey, the coefficient of alpha (α) is used for reliability analysis and α values as shown in Table 3 fulfilled the criteria > 0.700 (Nunally, 1978). The highest reliability detected is from service quality and system quality, with 0.901 and 0.932 respectively.

Table 3. Cronbach α for all study variables

Variables	Cronbach's α
Digital Library Collection	0.803
Information Quality	0.760
Perceived Ease of Use	0.831
Perceived Usefulness	0.801

Service Quality	0.901
System Quality	0.932
Student's Satisfaction	0.862

Summary statistics

Table 4 displays the summary statistics for all study variables. The average mean of each study variable exhibits inclination towards strong positive agreement towards the items asked in the questionnaires. Moreover, the small standard deviations indicate the response's distribution are less spread out from the mean. In other words, most of responses given by respondents converged to a similar agreement with respect to the item measurements set in the questionnaire.

Table 4. Mean and Standard Deviation (SD) of study variables.

Determinants	Mean	SD
Students' Satisfaction	4.165	0.658
Perceived Ease of Use	4.235	0.616
Perceived Usefulness	4.280	0.661
Information Quality	4.285	0.683
System Quality	4.137	0.69
Service Quality	4.059	0.677
Digital Library Collection	4.176	0.674

The usage determinants

According to Hong et al. (2002), a DL is a knowledge system that is multifaceted. Students tend to use it frequently if they feel the DL satisfies their study needs. The determinant of Perceived Ease of Use item of *Learning to use this digital library is easy (mean=4.27, SD=0.589, p<0.00)*; is one of the highest mean scores items of this determinant. The results may indicate using such DL makes their study experience better which so forth promotes more usability. Likewise, easy to use would also influence the users' intentions of using digital library either directly or indirectly (Thong et al., 2002).

The items measurement in Perceived Usefulness determinant showed that the highest mean score is for item: *The digital library in our university improves my work and life efficiency (mean=4.32, SD=0.614, p<0.00)*. This result was actually supported by previous studies where perceived usefulness implies the interpretation of device efficacy by users, illustrating how much the use of an information system improves efficiency as per indicated by Park et al. (2011). Hence, this basis demonstrates a portion of satisfaction of students using DL.

The information quality determinant

According to Masrek et al. (2010), Chang (2013), Lwoga (2013), and Masrek & Gaskin (2016), quality of information is considered as the primary determinant of the satisfaction of users with the digital library. As for the study, the result of item measurement of Information Quality: *The information provided by this digital library is comprehensive (mean=4.31, SD=0.665, p<0.00)* shows the highest mean score. It shows that information quality really gives a big impact on digital library as being supported by previous study.

The effectiveness performance of the academic DL

Results of System Quality shows that the item: *The digital library has an easy navigation of information (mean=4.24, SD=0.714, p<0.00)* has the highest mean score. Ramayah (2006) stressed on the importance of navigation to make efficient use of an information system and to avoid getting lost in the unhindered flow of information. Study done by Omotayo and Haliru (2020) also concluded that navigation clarity is one of the predictors of increased usability of DL.

The DL collection variable of this study is used to evaluate the effectiveness of collection for students, recognition of the presence of the collection among them and frequent use of this digital collection. The measurement items are based on the Information Search Process (ISP) model by Kuhlthau (2004, 2008), which identifies the three characteristics of experience by the user such as the affective (feelings), the cognitive (thoughts) and also the physical (actions) when exploring the DL collection. Finding indicates that the mean item: *The digital library collection provided by this digital library is up-to-date (mean=4.22, SD=0.694, p<0.00)* is the highest score. It shows that how critical the most recent collection to be provided by the university's digital collections for academic learning and as well as for teaching purposes.

Correlation analysis

The correlation coefficient (denoted by *r*), is a measure of the strength of linear relationship between two variables. The value of *r* ranges between -1 and +1. A positive *r* value indicates that as one variable increases so does the other, and an r of +1 indicates that knowing the value of one variable allows perfect prediction of the other.

Correlation analysis for this study is conducted to associate between the response variable and all of the posited study determinants. This correlational study is a preliminary analysis prior to examining the relationship using generalized linear model or structural analysis. The results indicate that all of the posited determinants possess significant positive relationships with students' satisfaction, ranging from r = 0.45 (the lowest) to r = 0.70 (the highest). Note that the correlation coefficient values are showing the existence of moderate bivariate linear relationships of the determinants and students' satisfactions. In Table 5, the coefficients of correlation are presented where perceived of usefulness shows the highest strength and with positive magnitude towards students' satisfaction in using DL for their learning activities (r = 0.70). In Li & Liu (2019) study on examining the user interaction components for DL

evaluation, they found that well organized website, rich and valid links, easy to learn, accessibility, usefulness, familiarity with task procedure are among the factors related to user interaction in evaluating the DL performance.

Table 5. Correlation coefficient for each determinant.

Determinants	Correlation coefficient
Perceived Ease of Use	0.55
Perceived Usefulness	0.70
Information Quality	0.45
System Quality	0.64
Service Quality	0.61
Digital Library Collection	0.58

Note: all are significant at 5% significance level

A strong positive magnitude correlation may indicate exist relationship between response variable and predictors but not indicating the cause and impact per se. Also, a serious multicollinearity issue is expected to arise especially in generalized model technique as most these predictors are correlated to each other. It could lead to unreliable and unstable estimates of linear generalized regression coefficients. Thus, these bivariate relationships results serve as empirical evidence as basis to a larger scope of research to embark on Partial Least Square (PLS) model rather than using linear generalized model. It is mainly to avoid the variance of model's coefficient inflated due to linear dependence with other predictors. In PLS model, its new components (the composition of significant predictors) maximize the covariance between predictors and the response variable that are uncorrelated to each other. In other words, the new components are uncorrelated with each other which may not be achieved when using linear model method.

On another note, a caution has to be made on developing PLS with total-effect model due to in some situations it may produce a misleading non-significant relationship of direct-effect when mediational effect is in fact strong (Zhao, Chen and Tong, 2011). Indirect-effect model via mediational effect might produce a goodness of fit model to clearly elucidate the role those insignificant predictors towards students' satisfaction in using DL. Hence moving forward (out of this paper's scope), the study would opt PLS model to reach the aim of identifying the key components (of predictors) impacting the student's satisfaction in using academic DL. Moreover, by leveraging on the similar determinants but with different setting of model framework, the authors would be focussing on testing the mediational effect between the predictors and students' satisfaction in using academic DL.

5 Conclusion

A correlational study on digital library effectiveness towards higher institution students of public university is presented in this paper. This preliminary study is conducted during pandemic period thus the dependency towards online sources is much prevalent when university opts online learning method. Due to the needs of completing assignments, projects or other academic activities, students do require sources from digital library more than before. Finding reveals that the existence of DL is very much critical to support their study performance as much as the quality of DL, which is also the one that they are concerning on, in particularly during this pandemic period. Due to lockdown or MCO set by the government, the new normal with online learning is the core study model, not only for higher education level but also for primary and secondary education levels. This situation brings most of students to adapt the use of DL in a more frequent manner and more dependency towards this IS as compared to before the pandemic period. Hence, DL must have its own value proposition to fit with the current situation and demand from students to accommodate their academics needs.

This study belongs to a part of a bigger research to investigate the effectiveness of academic DL where it equally provides empirical data for bigger research on influencing the satisfaction of using DL among varsity students.

References

Auguie, B. 2017. gridExtra: Miscellaneous Functions for "Grid" Graphics. R package version 2.3. Available at: https://CRAN.R-project.org/package=gridExtra .

Baron, R. M. and D.A. Kenny. 1986. The moderator-mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, Vol.51, no.6: 1173-1182.

Davis, F. D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, Vo.13, no.3: 319-339.

Eiriemiokhale, K.A. and A.O. Idowu. 2021. Perceived Ease of Use and Usefulness as Correlates of Electronic Databases Usage by University Lecturers in South-West, Nigeria, *International Journal on Integrated Education*, Vol.4, no.1: 10-20.

Freeze, R.D., K.A. Alshare, P.L. Lane and H.J. Wen. 2010. IS success model in e-learning context based on students' perceptions. *Journal of Information Systems Education*, Vol.21, no.2:173.

Harrell Jr., F.E. and C. Dupont. 2021. Hmisc: Harrell Miscellaneous. R package version 4.5-0. Available at: https://CRAN.R-project.org/package=Hmisc .

Hong, W., J.Y.L. Thong, W.M. Wong and K.Y. Tam. 2002. Determinants of user acceptance of Digital Libraries: an empirical examination of individual differences and system characteristics. *Journal of Management Information Systems*, Vol.18, no.3: 97-124.

Jeong, H. 2011. An investigation of user perceptions and behavioral intentions towards the e-library. *Library Collection, Acquisitions, and Technical Services*, Vol.35, no.2-3: 357-389.

Kuhlthau, C.C. 2004. Seeking meaning: a process approach to library and information services. 2nd ed. Westport, Connecticut: Greenwood Press.

Kuhlthau, C.C. 2008. From information to meaning: Confronting challenges of the twenty-first century. *Libri*, Vol.58, no.2: 66-78.

Lee, G.T., N. Dahlan, T. Ramayah, N. Karia, and M.A.H Asaari. 2005. Impact of interface characteristics on Digital Libraries usage. *Malaysian Online Journal of Instructional Technology*, Vol.2, no.1: 1-9.

Li, Y. and C. Liu. 2019. Information resource, interface, and tasks as user interaction components for digital library evaluation. *Information Processing and Management*, Vol.56: 704-720.

Li, S., F. Jiao, Y. Zhang and X. Xia. 2019. Problems and changes in digital libraries in the age of big data from the perspective of user services. *The Journal of Academic Librarianship*, Vol.45: 22-30.

Lwoga, E. T. 2014. Critical success factors adoption of web-based learning management systems in Tanzania. *International Journal of Education and Development using Information and Communication Technology (IJEDICT)*, Vol.10, no.1: 4-21.

Mortono, S., A. Nurkhin, H. Mukhibad and I. Anisyukrillah. 2020. Understanding the Employee's Intention to Use Information System: Technology Acceptance Model and Information System Success Model Approach, *Journal of Asian Finance, Economics and Business*, Vol.7, no.10: 1007–1013.

Masrek, M.N. & J.E. Gaskin. 2016. Assessing users' satisfaction with web digital library: the case of Universiti Teknologi MARA. *The International Journal of Information and Learning Technology*, Vol.33, no.1: 36-56.

Masrek, M.N., A. Jamaludin and S. Awang Mukhtar. 2010. Evaluating academic library portal effectiveness: A Malaysian case study. *Library Review*, Vil.59, no.3: 198-212.

Mathieu, J.E. and S.R. Taylor. 2006. Clarifying conditions and decision points for mediational type inferences in organizational behavior. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, Vol.27, no.8: 1031-1056.

Ogunrewo, O. J., Kolawole, J. A. & Osundina, K. S. (2015). Motivational factors as correlates of electronic information resources utilization among lecturers in private universities in south-west, Nigeria. *Journal of Knowledge Management, Economics and Information Technology*, Vol.5 no.5: 1-14

Omotayo, F. O. and A. Haliru. 2020. Perception of task-technology fit of digital library among undergraduate in selected universities in Nigeria. *The Journal of Academic Librarianship*, Vol.46: 1-10.

Park S., H. Zo, A.P. Ciganek & G.G. Lim. 2011. Examining success factors in the adoption of digital object identifier systems. *Electronic Commerce Research and Applications*, Vol.10, no.6: 626-636.

R Core Team. 2021. R: A language and environment for statistical computing. R Foundation for Statistical Computing, Available at: http://www.r-project.org/.

R Studio Team. 2021. RStudio: Integrated Development Environment for R. RStudio, PBC, Boston, MA. Available at: http://www.rstudio.com/.

Ramayah, T. (2006a). Doing e-research with e-library: determinants of perceived ease of use of e-library. *International Journal of Technology, Knowledge and Society*, Vol.1, no.4: 71-82.

Ramayah, T. (2006b). Interface characteristics, perceived ease of use and intention to use an online library in Malaysia. *Information Development*, Vol.22, no.2: 123-133.

Ramayah, T. and J.W.C. Lee. 2012. System characteristics, satisfaction and e-learning usage: a structural equation model (SEM). *The Turkish Online Journal of Educational Technology*, Vol.11, no.2: 196-206.

Razilan, A.K. (2012). An assessment of the performance of Digital Libraries based on an Information Impact model (Unpublished PhD Dissertation). Faculty of Computer Science and Information Technology, University of Malaya, Kuala Lumpur. 1-289.

Razilan, A.K., Saiful Farik M.Y., Muhammad Khairulnizam Z, and Wan Ab Kadir W.D.

(2015). Analysing Socio-Demographic Differences in the Use of Academic Digital Libraries of Postgraduate Students in Malaysia. *Australian Journal of Basic and Applied Sciences,* 9(3), 45-49.

Razilan, A.K., A.G. Rosnita, A.B. Amzari, B. Ap Azli and S. Mohd Ridwan. 2016. Factors Influencing User Satisfaction using Electronic Resources. Paper presented at 27th IBIMA Conference, May 2016 at Milan, Italy.

Roca, J.C., C.M. Chiu and F.J. Martinez. 2006. Understanding e-learning continuance intention: an extension of the Technology Acceptance Model. *International Journal of Human-Computer Studies*. Vol.64, no.8: 683-696.

Rose, B.M., G.N. Holmbeck, R.M. Coakley and E.A. Franks. 2004. Mediator and moderator effects in developmental and behavioral pediatric research. *Journal of Developmental & Behavioral Pediatrics*, Vol.25, no.1: 58-67.

Samadi, I., M.N. Masrek and S.F. Mat Yatin. 2014. The Effect of Individual Characteristics and Digital Library Characteristics on Digital Library Effectiveness: A Survey at University of Tehran. *World Applied Sciences Journal.* Vol.30, no.30: 214-220.

Sagar, V.R.V. (2006). A digital library success model for computer science student use of meta-search system. Unpublished Masters thesis, Virginia Polytechnic Institute and State University, Blacksburg, VA.

Soltani-Nejad, N., F. Taheri-Azad, N. Zarei-Maram and M.K. Saberi. 2020. Developing a model to identify the antecedents and consequences of user satisfaction with digital libraries, *Aslib Journal of Information Management*, Vol.72, no.6: 979-997.

Thong, W., J.Y.L. Thong and K.Y. Tam. 2002. Understanding user acceptance of digital libraries what are the roles of interface characteristics, organizational context, and individual differences? *International Journal of Human-Computer Studies*, Vol.57, no.3: 215-242.

Wickham, H. 2016. ggplot2: Elegant Graphics for Data Analysis. New York: Springer-Verlag.

Wickham, H. R. François, L. Henry and K. Müller. 2021. dplyr: A Grammar of Data Manipulation. R package version 1.0.7. Available at: https://CRAN.R-project.org/package=dplyr

Xie, I., R. Babu, T.H. Lee, M.D. Castillo, S. You and A.M. Hanlon. 2019. Enhancing usability of digital libraries: designing help features to support blind and visually impaired users. *Information Processing and Management*, Vol.57, no.3: 1-14.

Xu, F. and J. T. Du. 2018. Factors influencing users' satisfaction and loyalty to digital libraries in Chinese universities. *Computers in Human Behavior*, Vol.83: 64-72.

Yusoff, Y.M., Z. Muhammad, M.S.M. Zahari, E.S. Pasah and E. Robert. 2009. Individual differences, perceived ease of use, and perceived usefulness in the e-library usage. *Computer and Information Science*, Vol.2, no. 1: 76-83.