Bahaaeddin Alareeni
Allam Hamdan   *Editors*

Navigating the Technological Tide: The Evolution and Challenges of Business Model Innovation

Proceedings of the International Conference on Business and Technology (ICBT2024), Volume 1

Springer

Lecture Notes in Networks and Systems 1080

The series "Lecture Notes in Networks and Systems" publishes the latest developments in Networks and Systems—quickly, informally and with high quality. Original research reported in proceedings and post-proceedings represents the core of LNNS.

Volumes published in LNNS embrace all aspects and subfields of, as well as new challenges in, Networks and Systems.

The series contains proceedings and edited volumes in systems and networks, spanning the areas of Cyber-Physical Systems, Autonomous Systems, Sensor Networks, Control Systems, Energy Systems, Automotive Systems, Biological Systems, Vehicular Networking and Connected Vehicles, Aerospace Systems, Automation, Manufacturing, Smart Grids, Nonlinear Systems, Power Systems, Robotics, Social Systems, Economic Systems and other. Of particular value to both the contributors and the readership are the short publication timeframe and the world-wide distribution and exposure which enable both a wide and rapid dissemination of research output.

The series covers the theory, applications, and perspectives on the state of the art and future developments relevant to systems and networks, decision making, control, complex processes and related areas, as embedded in the fields of interdisciplinary and applied sciences, engineering, computer science, physics, economics, social, and life sciences, as well as the paradigms and methodologies behind them.

Indexed by SCOPUS, EI Compendex, INSPEC, WTI Frankfurt eG, zbMATH, SCImago.

All books published in the series are submitted for consideration in Web of Science.

For proposals from Asia please contact Aninda Bose (aninda.bose@springer.com).

Bahaaeddin Alareeni · Allam Hamdan
Editors

Navigating the Technological Tide: The Evolution and Challenges of Business Model Innovation

Proceedings of the International Conference on Business and Technology (ICBT2024), Volume 1

Editors
Bahaaeddin Alareeni 🆔
Middle East Technical University, Northern
Cyprus Campus
Güzelyurt, Türkiye

Allam Hamdan
College of Business and Finance
Ahlia University
Manama, Bahrain

If disposing of this product, please recycle the paper.

Contents

The Quality of E-Learning Services and Its Role in Elevating Student Satisfaction: Is There a Gender Difference?

Munjiati Munawaroh[1]([envelope]) [ID], Fauziyah[1] [ID], and Uswatun Chasanah[2] [ID]

[1] Management-Faculty of Economics and Business, Universitas Muhammadiyah Yogyakarta, Yogyakarta, Indonesia
{munjiatim,Fauziyah}@umy.ac.id

[2] Management-Widya Wiwaha College of Economics, Yogyakarta, Indonesia
uswatun.chasanah31@stieww.ac.id

Abstract. This study analyses the effect of e-learning service quality on student satisfaction regarding efficiency, fulfilment, system availability, and privacy at private Colleges in Yogyakarta, Indonesia. This research aims to contribute to higher education institutions providing quality electronic learning services to improve student satisfaction. This hypothetico-deductive study surveyed 459 purposively sampled students from three Muhammadiyah Colleges in Yogyakarta who used university electronic services. Survey data uses WarpPLS with regression analysis. The results showed that efficiency, system availability, and privacy significantly increased satisfaction but not fulfilment. Overall, e-service quality affected satisfaction. Among e-service dimensions, efficiency most affected satisfaction. This study supports the e-Servqual theory in education. For both men and women, efficiency, system availability, and privacy affected satisfaction. Statistically, junior and senior students were more satisfied with the efficiency and system availability. For seniors, privacy affected satisfaction more than for juniors.

Keywords: quality · e-service · university · satisfaction

1 Introduction

Information technology, especially e-services, has advanced quickly in the previous decade [1]. Physical engagement between consumers and companies has transitioned to non-physical (via Internet platforms). E-services allow companies to communicate with consumers and lower the expense of live consumer-provider interactions, giving them a competitive edge [2]. More consumers can access e-services, boosting market share and becoming a critical success factor [3]. Therefore, e-services must provide quality information to satisfy customers.

E-services research has been conducted in various sectors, e.g., banking [4], government [5], retail [6], and aviation [7], but rarely in universities [3]. This research evaluates private institutions' e-learning offerings in developing countries like Indonesia, as suggested by Muhammad et al. [8]. This research aims to contribute to developing-country private universities improving customer satisfaction.

Students are increasingly using e-services, especially e-learning. E-services at universities increased during the COVID-19 epidemic because of limited face-to-face interactions between academics, such as lecturers and students, and students and non-academic personnel [3, 9]. According to Zeithaml [2], e-service quality is how well websites facilitate shopping, purchasing, and delivery. High-quality electronic services require understanding customers' perspectives, administering the web, answering emails, and making information easy to find [10]. E-learning includes all internet-based learning, and e-learning service quality refers to students' expectations of their college's online services [9, 11].

Previous studies have employed numerous education e-service quality dimensions. Meranga [12] studied how e-learning service quality affects student satisfaction using five dimensions: tangible, dependability, responsiveness, assurance, and empathy. E-service quality was measured by Leonnard [13] using Parasuraman et al. [10], comprising efficiency, fulfilment, system availability, and privacy dimensions. Hence, this study focuses on e-learning service quality and measures its use efficiency, fulfilment, system availability, and privacy dimensions.

Furthermore, to satisfy customers, higher education improves electronic services, including e-learning [8, 9, 11, 12, 14, 15]. Previous studies have examined the influence of e-learning service quality dimensions on customer satisfaction, but the results are inconclusive. Pham's [14] found that the e-learning system, instructor, course material quality, and administrative and supporting service quality raise satisfaction. Leonnard [13] found that efficiency and fulfilment improve satisfaction, while privacy and system availability is not. Previous research uncovered that e-learning system quality and information quality significantly positively affect satisfaction [9]. This shows that the effect of each e-service quality component on satisfaction varies [13]; findings may rely on age, past e-learning experience, educational background, and cultural factors [14, 15]. Due to inconclusive earlier research, this study examines the impact of e-service quality on student satisfaction, in terms of efficiency, fulfilment, system availability, and privacy, in private colleges in Yogyakarta, Indonesia. This research is expected to contribute to higher education institutions providing quality electronic services to increase student user satisfaction. Muhammadiyah College in Yogyakarta was chosen because, historically, in Indonesia, Yogyakarta is known as "*kota pelajar*," or "the student's city" [16, 17].

Muhammadiyah is an organisation that promotes Islamic values through religious activities, health (hospitals, clinics), and social welfare (orphanages, nursing homes, environment conservation, and education) [18]. In education, Muhammadiyah central leadership primary and secondary education council and basic education data report 3,334 schools, including 1,904 primary schools, 558 high schools, and 554 technical high schools. There are six polytechnics, one academy, 54 high schools, 83 universities, 28 institutes, and 172 universities [19]. Universitas Muhammadiyah Yogyakarta, Universitas Ahmad Dahlan, and Universitas Aisyiyah are Yogyakarta's three major Muhammadiyah colleges.

2 Literature Review

2.1 Service Quality, E-Learning Service Quality, and Satisfaction

Traditional service quality begins with consumer interaction with the company directly without the help of the Internet. Service quality is assessed by comparing consumers' expectations with the actual performance of the service as perceived by the consumers [10]. The service quality dimensions of SERVQUAL include reliability, responsiveness, assurance, empathy, and tangibles [10]. Service reliability is on time and high quality. Providing appropriate service is responsiveness. The staff's friendliness, professionalism, and dependability are assurance. Empathy helps understand client requests and maintain contact. Tangibles include infrastructure, machinery, workforce, and communication resources. Traditional services must be converted to electronic ones due to technological advances. Companies must ensure electronic service quality [10].

The rapid development of technology encourages the automation of companies to provide services by facilitating interaction between consumers and non-physical companies (via platforms with the help of the Internet) [20]. Non-physical interactions between companies and consumers require quality e-services to provide information and easy access for consumers to achieve competitive advantage. E-service quality refers to the degree to which a website enables efficient and effective processes for shopping, purchasing, and delivery [2]. E-learning encompasses all types of learning supported by the Internet [9, 11]. E-learning service quality refers to the overall assessment of the services related to online learning students obtain from higher education institutions [15, 17].

There are four aspects of e-learning service quality [10]: 1. Efficiency refers to the ease and speed with which the site may be accessed and utilised; 2. Fulfilment refers to the degree to which the website's commitments regarding order delivery and product availability are met; 3. System availability refers to the website's accurate and efficient technical operation; 4. Privacy refers to the level of security and protection that the website offers for customer information. Most organisations find it challenging to provide quality e-services. Not updated web content, unresponsive to consumer questions on the web, late answers to emails to consumers, incomplete information on the web, and unmatching information with what consumers need indicate poor quality service.

Satisfaction results from any product or service experience [21]. Satisfaction refers to an individual's feelings of liking or disappointment that arise from comparing a product or service's perceived performance or outcomes with their expectations [22]. Customers are satisfied when performance or experience meets their expectations. If it doesn't meet expectations, the customer is unsatisfied; while exceeding expectations, they are very satisfied. Therefore, this study defines satisfaction as a person's feeling of e-learning service experience.

2.2 The Influence of E-Learning Service Quality on Consumer Satisfaction

Quality improves customer satisfaction [22]. Research shows that e-service quality increases satisfaction [23–25]. Mohammed et al. [8] measure online learning quality using SERVQUAL dimensions [21]—reliability, responsiveness, assurance, empathy,

and perceived ease of use. They found that reliability, assurance, empathy, and perceived ease of use affected satisfaction, but responsiveness did not. Leonard found that only efficiency and fulfillment levels affected user satisfaction from e-service quality elements [13]. This study investigated the impact of e-service quality on satisfaction using e-service quality theory, using efficiency, fulfilment, system availability, and privacy [21].

Efficiency is how easily and quickly the site can be used. Users are satisfied when they can log in, access the e-learning platform, and quickly traverse tasks and processes [26]. Fast page loading speeds also make studying more enjoyable and reduce interruptions. Users may easily traverse an intuitive, user-friendly e-learning platform, creating a conducive learning environment. Well-structured content helps learners find what they need quickly and improves their e-learning experience [27]. Technology and navigational issues can distract students from learning, while efficient content access lets them focus on the process. Therefore, efficiency affects satisfaction [13]. Hypotheses for this research are as follows.

H1: Efficiency positively and significantly impacts customer satisfaction.

E-learning fulfillment is how well the platform delivers on order delivery, product availability, and dependability [21]. Availability E-learning platforms make learning easier and more flexible by making educational resources available anytime, anywhere, and on any device. Fulfilment requires reliability, as no unexpected disruptions or inaction. The e-learning platform allows learners to participate in uninterrupted educational activities, building trust and confidence. User-friendly navigation and search functions make e-learning material more accessible. A well-designed interface improves user experience and boosts the perception of excellence and knowledge. Fulfillment improves customer satisfaction in e-learning by ensuring platform availability, dependability, accessibility, and usability [13]. Learning becomes enjoyable and rewarding. The following research hypothesis.

H2: Fulfilment positively and significantly impacts customer satisfaction.

The college's e-learning updates met student demands, aided students with academic activities, and improved the e-learning experience, enhancing student satisfaction. E-learning updates from the college met student needs since they were personalised to student needs and interests. The updates helped pupils with academics by meeting these demands. Easy access to course content, easy navigation, and better communication skills can increase student satisfaction [13]. In summary, the college's e-learning improvements met student needs, facilitated academic activities, and improved the e-learning experience, which raised student satisfaction. Following is this research hypothesis.

H3: System availability positively and significantly impacts customer satisfaction.

Privacy is the extent to which the e-learning is secure and protects customer information [21]. By placing privacy as a top priority and guaranteeing that users' personal information remains undisclosed to external entities, e-learning platforms cultivate trust and assurance among learners. Viewing the e-learning environment as secure and secured increases user satisfaction [13]. This research hypothesis is the following.

H4: Privacy positively and significantly impacts customer satisfaction.

The quality of e-learning services is determined by various important dimension, such as efficiency, fulfilment, system availability, and privacy. Optimising these aspects ensures learners have uninterrupted access to resources, receive educational content reliably, can consistently access the platform, and have their personal information well-protected. Consequently, learners experience a sense of support, appreciation, and safety within the e-learning environment, resulting in higher satisfaction with the educational service [13]. By prioritizing service quality, e-learning platforms may improve user experience, establish trust, and ultimately promote higher customer satisfaction, leading to more participation and success in online learning. This research hypothesis is the following.

H5: E-learning service quality positively and significantly impacts customer satisfaction.

3　Methodology

This study employed primary data using questionnaires using Google Forms. Surveys were used to gather data from respondents [28]. Yogyakarta Muhammadiyah College students participated in this study. Data was acquired using cross-sectional time horizon (certain phenomena at certain times) [28]. Analysis using regression with WARP PLS. Purposive sampling was used to obtain data from specific objectives, groups of people on a reasonable basis, or samples with specific criteria [28]. Actively attending courses and using university electronic services were the research sample requirements.

4　Result

Respondents included 487 Yogyakarta Muhammadiyah College students. Twenty-two respondents (4.5%) have never utilized e-learning, and six (1.2%) were not Yogyakarta Muhammadiyah College students. Thus, we processed 459 respondents. The survey was dominated by women (59.26%), unmarried (99.56%), and aged <20 (63.83%). Second-semester students dominated (54.68). Most responders use e-learning > three times a week (66.88%). Most responders (90.41%) have home Wi-Fi. (Table 1).

Table 1. Respondent profile

Characteristics Amount (N = 459) %			Characteristics Amount (N = 459) %		
Gender			*Semester*		
Man	187	40.74	<= Semester 2	251	54.68
Woman	272	59.26	>Semester 2	208	45.32
Marital status			*Frequency of using e-learning*		
Not married yet	457	99.56	Once a week	70	15.25
Married	2	0.44	Twice a week	45	9.8

(*continued*)

Table 1. (*continued*)

Characteristics Amount (N = 459) %			Characteristics Amount (N = 459) %		
Gender			*Semester*		
			Three times a week	37	12.05
Student age			>Three times a week	307	66.88
<= 20	293	63.83	*Availability of Wi-Fi in residence*		
21–25	162	35.29	Wi-Fi available	415	90.41
>25	4	0.87	No Wi-Fi available	44	9.59

4.1 Instrument Quality Test

To ensure the study's quality, the authors performed validity tests like average variance extracted (AVE) and confirmatory factor analysis scores, as well as reliability tests like Cronbach's alpha (CA). Instrument validity was confirmed by a loading score >0.7 and AVE >0.5 [29]. As Cronbach Alpha should be >0.6, the instrument was reliable with 0.869–0.948 [28]. (Table 2).

Table 2. Variable measurement

Dimension of E-learning service quality	Items	Loading Factor	AVE	Cronbach Alpha
Efficiency (Ef) is the ease and speed of accessing and using e-learning [21]	Ef_1	0.824***	0.852	0.905
	Ef_2	0.892***		
	Ef_3	0.832***		
	Ef_4	0.882***		
	Ef_5	0.827***		
Fulfilment (Ff) is the extent to which e-learning's promises regarding order delivery and product availability are fulfilled [21]	Ff_1	0.773***	0.794	0.883
	Ff_2	0.780***		
	Ff_3	0.764***		
	Ff_4	0.821***		
	Ff_5	0.832***		
	Ff_6	0.793***		
System availability (Sa) is the correct technical functioning of e-learning [21]	Sa_1	0.898***	0.896	0.877
	Sa_2	0.920***		
	Sa_3	0.869***		

Table 2. (*continued*)

Dimension of E-learning service quality	Items	Loading Factor	AVE	Cronbach Alpha
Privacy (Pv) is the extent to which the e-learning is secure and protects customer information [21]	Pv_1	0.939***	0.952	0.948
	Pv_2	0.932***		
Satisfaction (Ss) is a person's feeling of e-learning service experience [21]	Ss_1	0.940***	0.940	0.869
	Ss_2	0.940***		

Note: *** is significant at p-value < 0.001.

4.2 Descriptive Analysis, Correlation Between Variables, Collinearity Test, and Common Method Bias Test

All mean efficiency, fulfilment, system availability, privacy, and satisfaction scores are >4. In this study, VIFs <5 and ideally ≤3.3 show no multicollinearity or common method bias in the model [30] (Table 3).

Table 3. Descriptive analysis, Collinearity and common method bias tests and correlation between variables

Dimensions	Descriptive Analysis		VIFs	Correlation between Variables				
	Average	Standard Deviation		(1)	(2)	(3)	(4)	(5)
(1) Efficiency	4.068	0.622	2.710	1				
(2) Fulfilment	4.140	0.542	3.597	0.689 ***	1			
(3) System Availability	4.153	0.592	3.563	0.665 ***	0.776 ***	1		
(4) Privacy	4.211	0.657	1.855	0.582 ***	0.617 ***	0.625 ***	1	
(5) Satisfaction	4.118	0.663	2.544	0.718***	0.614***	0.697***	0.559***	1

Note: *** is significant at p-value < 0.001.

Hypotheses 1 to 4 were tested using multiple regression and hypothesis 5 using simple linear regression with WARP PLS. (Table 4). Efficiency ($\beta = 0.431$, $p < 0.001$), system availability ($\beta = 0.375$, $p < 0.001$), and privacy ($\beta = 0.085$, $p < 0.05$) positively significantly influenced satisfaction. Fulfilment ($\beta = -0.011$, $p > 0.05$) did not impact satisfaction ($\beta = 0.759$, $p < 0.001$). E-learning service quality impact to satisfaction. Therefore, hypotheses 1, 3, 4 and 5 were supported, however 2 was not. Privacy is the most influential component of customer satisfaction.

Hypothesis 1 was supported, as efficiency improved student satisfaction. Student satisfaction in higher education e-learning increases with easy accessibility, quick process completion, fast website page loading, user-friendliness, and effective organisation. This study also implies that the seamless and efficient operation of the e-learning platform improves student satisfaction [14]. Such insights help educational institutions adapt their e-learning platforms to changing student needs.

Nevertheless, this research failed to support hypothesis 2. In e-learning, fulfilment did not affect satisfaction. The research findings pointed to students' noticeable lack of emphasis on specific facets of e-learning, encapsulated by fulfilment when shaping their overall satisfaction. When rating satisfaction, students may not prioritise ease of accessing information, presentation quality, design, layout, information updates, and e-learning's academic role. In such instances, fulfilment may not be a differentiating factor in overall satisfaction. Many factors may explain the non-significant association between fulfilment and e-learning service quality. Previous research showed that cultural differences [14], prior e-learning experience, and educational background might affect relationship service quality and student satisfaction [15].

System availability statistically improves e-service quality and student satisfaction, supporting hypothesis 3. This study shows that the accessibility and seamless functionality of university e-learning platforms greatly impact student satisfaction. System availability is crucial to student satisfaction, according to the findings. The user experience is improved when the e-learning system is available at any time, location, or device. To satisfy modern student expectations, the robust technological infrastructure and continual system functionality. Educational institutions that prioritise and invest in maintaining high levels of system availability in their e-learning services are likely to enhance student satisfaction. The study emphasises robust technological infrastructure and continual system functionality to satisfy modern student expectations. Today, seamless access to educational resources and platforms is essential for optimal learning. The study shows that a reliable, always-available e-learning system promotes student engagement and academic success. This validates earlier research that system quality strongly affects student satisfaction with e-learning [9].

The study's findings reinforce hypothesis 4, affirming a positive and statistically significant relationship between e-learning privacy and student satisfaction. This study found that student satisfaction increases when a college protects personal data, does not share it, and maintains security. Results show that privacy matters in students' e-learning platform views and satisfaction. Schools that prioritise data security and e-learning security will likely increase student trust and satisfaction. The study's favourable association between privacy and satisfaction emphasises the need for transparent and secure e-learning in an age of data privacy. In the digital age, educational institutions must prioritise privacy to improve student satisfaction with e-learning systems. Overall, this study supports the fifth hypothesis that e-learning service quality increases student satisfaction.

4.3 Additional Analysis

Table 5 examines gender and academic experience. Both men ($\beta = 0.356$, $p < 0.001$) and women ($\beta = 0.505$, $p < 0.001$) showed a significant impact of efficiency on satisfaction.

Table 4. Hypothesis testing

Variable	β (N = 459)
Dependent Variable: Satisfaction	
Efficiency	0.431***
Fulfilment	− 0.011
System Availability	0.375***
Privacy	0.085*
Dependent Variable: Satisfaction	
e-learning service quality	0.759***

Note: * significant at $p < 0.05$; ** significant at p-value < 0.01, *** significant at p-value < 0.001.

This study shows that all students prefer fast completion and accessibility. Designers must understand and make efficient e-learning elements for gender inclusion to improve satisfaction.

Fulfillment has no significant effect on satisfaction for both men ($\beta = 0.005$, $p > 0.05$) and women ($\beta = 0.057$, $p > 0.05$ Students, regardless of gender, may not prioritise or carefully consider fulfilling factors when rating e-learning pleasure. Fulfillment-related dimensions are reassessed. It focuses on various aspects that may affect e-learning satisfaction for learners.

Table 5. Additional analysis

Variable	Gender		Academic experience	
	Man	Women	Junior (Semester 2)	Senior (>Semester 2)
	β (N = 187)	β (N = 272)	β (N = 251)	β (N = 208)
Dependent Variable: Satisfaction				
Efficiency	0.356***	0.505***	0.537***	0.280***
Fulfilment	0.005	0.057	0.038	0.077
System Availability	0.485***	0.260***	0.348***	0.349***
Privacy	0.078	0.142***	0.049	0.159***
Dependent Variable: Satisfaction				
E-service quality	0.759***	0.711***	0.779***	0.722***

Note: * significant at $p < 0.05$; ** significant at p-value < 0.01, *** significant at p-value < 0.001.

System availability significantly impacted satisfaction for both men ($\beta = 0.485$, $p < 0.001$) and women ($\beta = 0.260$, $p < 0.001$). These data indicate that both male and female students value e-learning platforms' constant accessibility and functionality. Since a reliable and always-available e-learning system improves user experience, it

improve satisfaction. The strong impact of system availability on student satisfaction highlights the importance of technological infrastructure in e-learning platform satisfaction. These findings underline educational institutions need to prioritise and invest in system availability to improve student satisfaction. The study concludes that a dependable and highly accessible e-learning system creates a favourable learning environment for both male and female students. To satisfy both genders of students, institutions should consider these results when designing and managing their e-learning platforms.

Study finds system availability in e-service quality improves student satisfaction. The results highlight that the accessibility and functionality of university e-learning systems greatly impact student satisfaction. However, privacy's effect on satisfaction shows a gender gap. The study found no significant impact of privacy on male students' satisfaction ($\beta = 0.078$, $p > 0.05$). Female students showed a substantial influence of privacy on satisfaction ($\beta = 0.142$, $p < 0.001$), indicating that they gain satisfaction from the e-learning environment. The gender-specific findings highlight the complexity of e-service quality satisfaction drivers. The study emphasises customising privacy measures to male and female student preferences and expectations. To create an inclusive and satisfying learning environment, institutions must recognise and address gender-specific satisfaction factors as they improve e-learning platforms.

A comprehensive study demonstrated that e-service quality consistently influences men's and women's satisfaction ($\beta = 0.759$, $p < 0.001$ for men; $\beta = 0.711$, $p < 0.001$ for women). According to the study, e-service quality greatly impacts student satisfaction regardless of gender. Positive coefficients indicate that as e-service quality improves, male and female students are more satisfied. These findings underline the institution's crucial role in improving e-service quality to suit students' requirements and expectations. The students' results show that e-service quality drives satisfaction, which might help educational institutions improve their e-learning platforms. Understanding the importance of e-service quality for men and women highlights the need for a holistic and inclusive approach to improving and enhancing e-services to improve learning.

Additionally, efficiency variables and student satisfaction were linked to the academic experience. Efficiency increases satisfaction for Junior (second semester) ($\beta = 0.537$, $p < 0.001$) and senior students (greater than second semester) ($\beta = 0.280$, $p < 0.001$). Efficiency-related factors, including easy accessibility and quick completion, boost student satisfaction across academic levels, according to these data. This shows that students of all academic backgrounds value fast and efficient e-learning. Using these data, educational institutions can adjust their e-learning platforms to prioritise efficiency-related aspects to fulfil students' expectations at different phases of their academic journey.

In e-learning, the study shows that fulfilment did not affect satisfaction for both junior ($\beta = 0.038$, $p > 0.05$) and senior students ($\beta = 0.077$, $p < 0.05$), demonstrating a uniform pattern across academic levels. These findings indicate that students place less importance on satisfaction factors like ease of discovering information, presentation quality, design, layout, information updates, and the academic significance of e-learning. Non-significant coefficients suggest these fulfilment-related factors may not

significantly affect junior and senior student satisfaction. As shown by fulfilment's non-significant impact, institutions may need to focus more on other factors that affect satisfaction. Recognising student choices and expectations helps e-learning platforms match educational satisfaction parameters.

Study found a strong positive and statistically significant effect of system availability in e-service quality and student satisfaction. Accessibility and functionality of e-learning platforms affect student satisfaction, making them crucial in universities. This study indicated that system availability significantly affected satisfaction for both junior ($\beta = 0.348$, $p < 0.001$) and senior students ($\beta = 0.349$, $p < 0.001$). These findings suggest that system availability matters across academic levels. E-learning availability boosts junior and senior students' satisfaction, as positive beta coefficients show. The results show that technical infrastructure is crucial to student satisfaction in education. Educational institutions can boost student satisfaction throughout their academic careers by prioritising and maintaining system availability. These findings help universities enhance their e-learning platforms and give students a constantly accessible and rewarding learning experience.

Privacy had a substantial impact on satisfaction for seniors ($\beta = 0.159$, $p < 0.001$) but not for juniors ($\beta = 0.049$, $p > 0.05$). The research found an intriguing age-dependent relationship between privacy and e-learning service pleasure. This contrast shows that e-learning privacy perceptions may change as students progress academically. The impact of e-learning privacy on student satisfaction is dynamic, with different factors weighing more at different academic levels. Junior and senior privacy attitudes differ, highlighting the need to tailor e-learning services to different student demographics. Especially as pupils go through school, educational institutions should explore customised privacy initiatives. This research urges educational institutions to reassess e-learning practices based on the distinct effects of privacy on academic satisfaction. Institutions may improve their e-learning service quality and suit the various needs of junior and senior students by studying and adjusting to these differences.

In conclusion, the study indicates a strong correlation between e-service quality and student satisfaction across academic levels, with junior ($\beta = 0.779$, $p < 0.001$) and senior ($\beta = 0.722$, $p < 0.001$). Positive beta coefficients confirm that e-service quality improves satisfaction for both groups. Improved student satisfaction requires institutions to invest in e-service quality, adapt to their diverse student body's needs, and prioritize it across academic stages.

5   Conclusion, Limitations, and Future Research

This study verifies the e-service quality theory [10] for e-learning service quality in education, focusing on Muhammadiyah Colleges in Yogyakarta, Indonesia. Customer satisfaction was favourably and significantly affected by e-learning service quality[10]. This study shows not all e-service quality factors affect consumer satisfaction. Efficiency, system availability, and privacy positively and significantly affected satisfaction but not fulfilment. Cultural differences, e-learning experience, and education can affect relationship service quality and student satisfaction [14, 15].

Future research could use qualitative methods to examine how specific fulfilment impacts satisfaction in a cultural context to promote generalisability.

Regarding additional analysis of gender, the results revealed that the impact of efficiency, system availability, and privacy on satisfaction was significant for both men and women. The results of this research contribute to institutions improving inclusive e-learning platforms as a driver of student satisfaction. Concerning academic levels, both junior (second semester) and senior (more than second semester) students exhibited a substantial and statistically significant increase in satisfaction with efficiency and system availability. This study found that the impact of privacy on satisfaction was not significant for juniors but was significant for seniors.

This study is not without limitations. Considering temporal differences, this cross-sectional study examined how e-learning service quality affects satisfaction. Privacy in e-learning service quality affected satisfaction differently for junior and senior students. Future research could delve deeper through longitudinal studies spanning multiple semesters, tracking students from their initial enrollment through subsequent academic terms.

References

1. Ali, H.: Measurement of e-services quality: an empirical study of university of Bahrain. Educ. Inf. Technol. **24**(3), 1907–1924 (2019)
2. Zeithaml, V.A.: Service excellence in electronic channels. Manag. Serv. Qual. Int. J. **12**(3), 135–139 (2002). https://doi.org/10.1108/09604520210429187
3. Jameel, A.S., Hamdi, S.S., Karem, M.A., Raewf, M.B., Ahmad, A.R.: E-satisfaction based on e-service quality among university students. J. Phys. Conf. Ser. **1804**(1), 012039 (2021). https://doi.org/10.1088/1742-6596/1804/1/012039
4. Alarifi, A.A., Husain, K.S.: The influence of Internet banking services quality on e-customers' satisfaction of Saudi banks: comparison study before and during COVID-19. Int. J. Qual. Reliab. Manag. **40**(2), 496–516 (2023)
5. Elmi, Y.: A feasibility study on importance of using Big data Analysis in implementing E-government services (2021)
6. Ming, G.: Online retail service quality, who satisfy? Customer satisfaction. J. Digitainability Realism Mastery (DREAM) **1**(01), 1–11 (2022)
7. Akbar, N.Z., Putri, V.H., Marina, S., Liana, E.: The effect of electronic word of mouth and electronic service quality on purchase intention of tickets of citilink Indonesia airline. Adv. Transp. Logist. Res. **4**, 597–609 (2021)
8. Mohammed, M., Xizheng, Z., Abdo, A.-B., Abdulwase, R.: The impact of online learning service quality on student satisfaction and loyalty during the COVID-19 pandemic. J. Posit. Sch. Psychol. **6**(2), 3682–3715 (2022)
9. Dangaiso, P., Makudza, F., Hogo, H.: Modelling perceived e-learning service quality, student satisfaction and loyalty. A higher education perspective. Cogent Educ. **9**(1), 2145805 (2022). https://doi.org/10.1080/2331186X.2022.2145805
10. Parasuraman, A., Zeithaml, V.A., Malhotra, A.: E-S-QUAL: a multiple-item scale for assessing electronic service quality. J. Serv. Res. **7**(3), 213–233 (2005). https://doi.org/10.1177/1094670504271156
11. Wu, B.: Identifying the influential factors of knowledge sharing in e-learning 2.0 systems. Int. J. Enterp. Inf. Syst. (IJEIS) **12**(1), 85–102 (2016)
12. Meranga, I.S.: Effect of service quality and e-learning quality on student satisfaction in moderation of social distancing during the COVID-19 pandemic: empirical studies in private universities. Bp. Int. Res. Critics Inst. J. (BIRCI-J.) **5**(2), 9935–9942 (2022)

13. Leonnard, L.: Exploring the relationship among e-service quality, e-trust, e-satisfaction and loyalty at higher education institutions. J. Eff. Responsib. Educ. Sci. **12**(4), 103–110 (2019)
14. Pham, L., Limbu, Y.B., Bui, T.K., Nguyen, H.T., Pham, H.T.: Does e-learning service quality influence e-learning student satisfaction and loyalty? Evidence from Vietnam. Int. J. Educ. Technol. High. Educ. **16**(1), 7 (2019). https://doi.org/10.1186/s41239-019-0136-3
15. Yu, Q.: Factors influencing online learning satisfaction. Front. Psychol. **13**, 852360 (2022)
16. Central Bureau of Statistics: About Yogyakarta | 7th International Conference on Big Data and Data Science for Official Statistics. https://unbigdata.bps.go.id/yogyakarta. Accessed 31 Dec 2023
17. Sugiyanto, S.: Yogyakaria Kota Pendidikan Dan Ekonomi Alternatif. Jurnal Cakrawala Pendidikan **3**(3), Article no. 3 (2004). https://doi.org/10.21831/cp.v3i3.7594
18. Muhammadiyah, P.P.: Sejarah Singkat Muhammadiyah, Muhammadiyah. https://muhammadiyah.or.id/sejarah-singkat-muhammadiyah. Accessed 31 Dec 2023
19. Kapitan, H.: Jejak Perjuangan Jalan Pendidikan Muhammadiyah, Muhammadiyah. https://muhammadiyah.or.id/jejak-perjuangan-jalan-pendidikan-muhammadiyah/. Accessed 31 Dec 2023
20. Voss, C.A.: Rethinking paradigms of service: service in a virtual environment. Int. J. Oper. Prod. Manag. **23**(1), 88–104 (2003). https://doi.org/10.1108/01443570310453271
21. Parasuraman, A., Zeithaml, V.A., Berry, L.L.: A conceptual model of service quality and its implications for future research. J. Mark. **49**(4), 41–50 (1985)
22. Kotler, P., Keller, K.: Marketing Management (15th Global Edition). Pearson Education Limited (2021). http://dspace.vnbrims.org:13000/xmlui/handle/123456789/5050. Accessed 16 Feb 2024
23. Quan, S.: Assessing the effects of e-service quality and e-satisfaction on internet banking loyalty in China. In: 2010 International Conference on E-Business and E-Government, pp. 93–96. IEEE (2010). https://ieeexplore.ieee.org/abstract/document/5591139/. Accessed 17 Feb 2024
24. Sheng, T., Liu, C.: An empirical study on the effect of e-service quality on online customer satisfaction and loyalty. Nankai Bus. Rev. Int. **1**(3), 273–283 (2010)
25. Tandon, U., Kiran, R., Sah, A.: Analyzing customer satisfaction: users perspective towards online shopping. Nankai Bus. Rev. Int. **8**(3), 266–288 (2017). https://doi.org/10.1108/NBRI-04-2016-0012
26. Ranadewa, D.U.N., Gregory, T.Y., Silva, J., Boralugoda, D.N., Jayasuriya, N.A.: Impact of online learning efficiency on students' satisfaction and commitment during Covid-19-a concept paper (2021). Accessed 15 Feb 2024
27. Alqahtani, M.A., Alamri, M.M., Sayaf, A.M., Al-Rahmi, W.M.: Exploring student satisfaction and acceptance of e-learning technologies in Saudi higher education. Front. Psychol. **13**, 939336 (2022)
28. Sekaran, U., Bougie, R.: Research Methods for Business: a Skill-Building Approach, 7th edn. Wiley, Chichester (2016)
29. Hair, J.F., Black, W.C., Babin, B.J., Anderson, R.E.: Multivariate Data Analysis, 8th edn. Annabel Ainscow, United Kingdom (2019)
30. Kock, N.: WarpPLS User Manual: Version 7.0, p. 141. ScriptWarp Systems, Laredo, TX, USA (2020)