

Service Digitalization, Service Quality, and Student Satisfaction: The Mediating Role of Operational Efficiency

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ABSTRACT

This study investigates how the digitalization of academic services and the quality of administrative services affect student satisfaction, with operational efficiency as a mediator at Riau Islamic University. A cross-sectional survey of 226 active students from multiple faculties was analyzed using structural equation modeling. Measurement checks indicated that the scales were reliable and valid. Results show that digitalization improves operational efficiency but does not directly increase student satisfaction. In contrast, higher administrative service quality improves both operational efficiency and student satisfaction. Operational efficiency also mediates the relationships between digitalization and satisfaction, and between service quality and satisfaction. The model explained roughly three-quarters of the variance in operational efficiency and student satisfaction, indicating strong explanatory power. The findings suggest that universities will realize the benefits of digital transformation for students when efficient internal processes support well-designed digital systems and responsive administrative services.

INTRODUCTION

Advances in information and communication technology have driven significant changes in operational management across sectors, including higher education. Universities now function not only as academic institutions but also as service organizations that must provide effective and efficient services to students. In the context of operations management, digitalization is a primary strategy for improving the efficiency of service processes and enhancing user satisfaction (Heizer et al., 2020).

Universitas Islam Riau (UIR) has implemented various digital systems such as the Sistem Informasi Akademik (Sikad), Learning Management System (LMS), and online administrative systems to support the smooth execution of academic processes. However, based on preliminary observations, several challenges remain, including limited system integration, slow service response, and variations in service quality across units. This

indicates that the implementation of digitalization has not yet fully yielded an optimal impact on operational efficiency or student satisfaction.

According to Davis (1989) in the Technology Acceptance Model (TAM), technology acceptance is determined by perceived ease of use and perceived usefulness. If the digital academic system is easy to use and provides tangible benefits, it will lead to process efficiency and increased user satisfaction. The study by Putra & Lestari (2022) found that the digitalization of academic services has a positive effect on service effectiveness and student satisfaction in higher education. Thus, it can be formulated.

H1: that the digitalization of academic services has a positive effect on student satisfaction.

Furthermore, digitalization is also believed to improve campus operational efficiency by accelerating the flow of information and reducing administrative errors. Integrated digital systems enable more effective inter-unit coordination, thereby allowing service processes to run more efficiently. Therefore, it can be proposed that.

H2: the digitalization of academic services has a positive effect on campus operational efficiency.

Furthermore, the quality of administrative services plays an important role in shaping students' perceptions of the university's service quality. Based on the SERVQUAL model developed by Parasuraman et al. (1988), service quality comprises five dimensions: tangibles, reliability, responsiveness, assurance, and empathy. Good administrative services reflect efficient and professional operational processes, which ultimately can increase student satisfaction. The study by (Fitriani et al., 2021) shows that the quality of administrative services has a significant effect on student satisfaction. Thus, it can be formulated.

H3: The quality of administrative services has a positive effect on student satisfaction.

The quality of administrative services is also closely related to organizational work efficiency. Fast, responsive, and accurate services indicate that human resources and campus operational systems have been utilized optimally. In other words, the better the quality of service, the higher the operational efficiency achieved by the institution. Based on this logic, it can be formulated

H4: The quality of administrative services has a positive effect on campus operational efficiency.

Operational efficiency describes an institution's ability to manage time, effort, and costs optimally in order to achieve maximum service output. In the context of higher education, operational efficiency means that academic and administrative service processes run quickly, accurately, and free from bureaucratic obstacles. The study by Wibowo & Handayani (2020) proves that operational efficiency has a significant influence on the satisfaction of users of educational services. Therefore, it is formulated

H5: Operational efficiency has a positive effect on student satisfaction.

Furthermore, operational efficiency is believed to be an intervening variable that strengthens the influence of digitalization and service quality on student satisfaction. When

digital systems and high-quality administrative services are implemented efficiently, students' experiences in interacting with campus services will increase significantly. Based on this theory, it can be formulated

H6 : Operational efficiency mediates the effect of the digitalization of academic services on student satisfaction.

H7 : Operational efficiency mediates the effect of the quality of administrative services on student satisfaction.

Based on the foregoing, this study develops a conceptual model that positions the digitalization of academic services (X1) and the quality of administrative services (X2) as independent variables, operational efficiency (M) as a mediating variable, and student satisfaction (Y) as the dependent variable. This study is expected to provide an empirical contribution to the development of operational management in higher education, particularly in efforts to optimize digital transformation to improve service quality and student satisfaction at Universitas Islam Riau.

METHOD

This study employs a quantitative approach with an explanatory design to test the effects of Digitalization of Academic Services (X1) and Quality of Administrative Services (X2) on Student Satisfaction (Y), with Campus Operational Efficiency (M) as a mediating variable. The primary analysis uses SEM-PLS (Partial Least Squares Structural Equation Modeling) so that direct and indirect relationships can be estimated on Likert-scale data without strict normality assumptions. Established methods for testing reliability, validity, and bootstrap mediation follow general SEM-PLS guidelines; only adjustments relevant to this study are specified so the study can be replicated as is.

The study population comprises active students of Riau Islamic University (UIR) in the current academic year. The sample size was determined through power analysis for regression with three predictors at a medium effect size ($f^2 = 0.15$), $\alpha = 0.05$, and power = 0.95, yielding a minimum requirement of approximately $n \approx 119$ respondents. To enhance the stability of SEM-PLS estimates and representation across faculties, the study targets ≥ 226 respondents (Faul F., 2009). The sampling technique employed is proportionate stratified random sampling based on faculty/study program/cohort (or purposive sampling if distribution channels are limited), with inclusion criteria: active students for at least one semester and who have used SIKAD/LMS/administrative services within the last 12 months.

Data were collected using a 1–5 Likert questionnaire (1 = strongly disagree to 5 = strongly agree) comprising four constructs: (i) Digitalization of Academic Services covering ease, process speed, system quality/integration, mobile access, self-service, and status tracking; (ii) Quality of Administrative Services encompassing the SERVQUAL dimensions of responsiveness, reliability, assurance, empathy, and tangibles; (iii) Operational Efficiency assessing waiting time, number of steps/procedures, inter-unit coordination, rework/first-time-right, and continuous evaluation; and (iv) Student Satisfaction including overall satisfaction,

confirmation of expectations, service convenience, and intention to recommend. Instrument development was conducted through content validation by two to three experts in campus services/operations. The main survey was distributed via Google Forms with screening (active students and service users), a single attention-check item, and informed consent. Data cleaning included removal of duplicate responses, straight-lining, attention-check failures, and completion-time outliers; missing data $< 5\%$ were imputed with indicator means, whereas $> 10\%$ for the same respondent were deleted listwise.

The specifications of tools and materials include SmartPLS 4 (or equivalent) for SEM-PLS modeling, statistical software (e.g., SPSS 26/27) for descriptive analysis and additional assumption checks, the Google Forms survey platform, and standard PC/laptop computing equipment (≥ 8 GB RAM) for 5,000-sample bootstrap replications. The analysis settings are described to ensure repeatability: in the reflective measurement model, internal reliability is evaluated via Cronbach's alpha and Composite Reliability (≥ 0.70), convergent validity via AVE (≥ 0.50) and outer loadings (ideal ≥ 0.70 ; ≥ 0.60 acceptable in exploratory research with justification), discriminant validity via the HTMT ratio (< 0.85), and indicator multicollinearity via VIF (< 5) (Hair et al., 2022). In the structural model, inter-construct collinearity is evaluated ($VIF < 3-5$), path coefficients are estimated using bootstrapping with 5,000 resamples (two-tailed, $\alpha = 0.05$), explanatory power is assessed through R^2 for endogenous constructs (operational efficiency and student satisfaction), effect sizes through f^2 (0.02 small; 0.15 medium; 0.35 large), and predictive relevance through Q^2 (blindfolding). Mediation tests are conducted for the $X1 \rightarrow M \rightarrow Y$ and $X2 \rightarrow M \rightarrow Y$ paths using 5,000 bootstrap samples; mediation is considered significant when the 95% confidence interval does not cross zero, and total effects as well as the type of mediation (full/partial) are also reported based on the significance of direct vs. indirect paths.

Potential common method bias is procedurally controlled by ensuring anonymity, randomizing item order, differentiating scales across constructs, and including an attention-check item, and is statistically tested using Harman's single-factor test ($< 50\%$) and/or full collinearity VIF (< 3.3) in PLS (Podsakoff et al., 2003). For replication purposes, the appendix includes the complete list of questionnaire items along with the codebook, and the results section will present modeling tables (loadings/CR/AVE/HTMT), path coefficients with confidence intervals, and R^2 , f^2 , and Q^2 metrics. The study complies with research ethics: internal ethical approval from the study program/faculty is obtained prior to data collection; each respondent provides informed consent, participation is voluntary, responses are anonymous, and data are reported only in aggregate.

RESULTS AND DISCUSSION

Table 1 Demographic

Faculties	Grade		Grand Total
	S1	S2	
Faculty of Islamic Studies	7		17
Faculty of Economics and Business	5		75
Faculty of Law	6		16
Faculty of Educational Sciences and Teacher Training	7		17
Faculty of Political Science	8		18
Faculty of Communication Studies	8		18
Faculty of Agriculture	3		23
Faculty of Psychology	0		20
Faculty of Engineering	6		16
Postgraduate		6	6
Grand Total	20	6	226

Frequency of Access	SIKAD/LMS	Total
>5 times	6	
1 times	3	
2- 4 times	27	
Grand Total	26	

Table 1 presents the characteristics of the study respondents, comprising 226 active students of Riau Islamic University (UIR) from various faculties and levels of study. The majority of respondents are from the Faculty of Economics and Business (75 students, 33.2%), followed by the Faculty of Agriculture (23 students, 10.2%), with other faculties contributing relatively even proportions. Based on the frequency of use of the university's

digital systems (SIKAD/LMS), most students access the system two to four times per week (127 students or 56.2%), indicating a relatively high level of adoption of digitalized academic services within the campus environment.

Table 2 Construct Validity and Reliability Results (AVE, CR, α)

Construct	Item Code	Outer loadings	AVE	Cronbach's alpha	Rho a	Rho c
OE	OE1	0.778	0.670	0.930	0.931	0.942
	OE2	0.849				
	OE3	0.793				
	OE4	0.812				
	OE5	0.835				
	OE6	0.832				
	OE7	0.839				
	OE8	0.809				
SD	SD1	0.761	0.664	0.928	0.929	0.941
	SD2	0.808				
	SD3	0.828				
	SD4	0.816				
	SD5	0.802				
	SD6	0.829				
	SD7	0.807				
	SD8	0.865				
SQ	SQ1	0.788	0.650	0.962	0.962	0.965
	SQ2	0.801				
	SQ3	0.838				
	SQ4	0.814				
	SQ5	0.788				
	SQ6	0.768				
	SQ7	0.820				
	SQ8	0.798				
	SQ9	0.808				
	SQ10	0.813				
	SQ11	0.818				
	SQ12	0.846				
	SQ13	0.766				
	SQ14	0.829				
	SQ15	0.798				
SS	SS1	0.877	0.740	0.929	0.931	0.945
	SS2	0.861				
	SS3	0.883				
	SS4	0.857				
	SS5	0.879				
	SS6	0.800				

Following the respondent profile, the next step was testing the reliability and validity of the constructs as shown in Table 2. The analysis indicates that all indicators satisfy the

measurement model criteria, with outer loadings above 0.75, Average Variance Extracted (AVE) ranging from 0.650 to 0.740, and Composite Reliability (CR) between 0.941 and 0.965. Cronbach's alpha values across all constructs are above 0.90, indicating excellent internal consistency of the instrument. These results confirm that the measurement model meets the criteria for convergent validity and construct reliability (Hair et al., 2022).

Table 3 Hypothesis Testing Results (Path Coefficient, t, p, Decision)

Hypothesis	Path	Std. Beta	Std. Error	T value	P values	Bias	Confidence Interval		VIF	Decision	R-square adjusted	f-square
							5%	95%				
H1	SD -> SS	0.040	0.064	0.621	0.267	0.012	0.113	0.459	2.285	Not supported	0.763	0.003
H5	OE -> SS	0.508	0.130	3.918	0.000	-0.002	0.280	0.708	4.265	supported		0.248
H3	SQ -> SS	0.361	0.142	2.538	0.006	0.007	-0.066	0.139	2.574	supported		0.129
H6	SD -> OE	0.132	0.062	2.144	0.016	0.004	0.055	0.260		supported		
H7	SQ -> OE	0.336	0.104	3.238	0.001	-0.006	0.184	0.533		supported		
H2	SD -> OE	0.260	0.106	2.459	0.007	-0.011	0.464	0.806	2.285	supported	0.753	0.127
H4	SQ -> OE	0.662	0.104	6.376	0.000	-0.003	0.133	0.596	4.157	supported		0.819

Next, Table 3 reports the results of hypothesis testing for the structural model using SEM-PLS. Six of the seven hypotheses are supported at $p < 0.05$. Academic Service Digitalization (SD) has a positive effect on Operational Efficiency (OE) ($\beta = 0.260$; $p = 0.007$) but does not have a direct effect on Student Satisfaction (SS) ($\beta = 0.040$; $p = 0.267$). Administrative Service Quality (SQ) has a significant effect on both OE ($\beta = 0.662$; $p = 0.000$) and SS ($\beta = 0.361$; $p = 0.006$). In addition, OE exerts a strong positive effect on SS ($\beta = 0.508$; $p = 0.000$).

The mediation analysis shows that OE significantly transmits the effect of SD on SS ($\beta = 0.132$; $p = 0.016$) and of SQ on SS ($\beta = 0.336$; $p = 0.001$). The adjusted R^2 values of 0.753 for OE and 0.763 for SS indicate high explanatory power, while a positive Q^2_{predict} value signifies good predictive relevance (Hair et al., 2022). Overall, these findings underscore operational efficiency as a key mechanism linking service digitalization and administrative service quality to student satisfaction.

Discussion

The findings indicate that the digitalization of academic services has a significant effect on operational efficiency, but no direct effect on student satisfaction. This suggests that the

benefits of digitalization are felt more strongly in the efficiency of internal processes than in users' satisfaction perceptions. This result supports the Technology Acceptance Model (TAM) proposed by Davis (1989), which explains that users' satisfaction with a digital system will increase only when the technology is perceived as useful and easy to use. In the UIR context, digitalization through SIKAD and the LMS has been shown to facilitate academic administrative activities, yet the user experience is not fully optimal due to persistent variation in responsiveness and technical support across units.

In contrast, the quality of administrative services (SQ) directly affects both student satisfaction (SS) and operational efficiency (OE). This finding is consistent with the SERVQUAL model of Parasuraman et al. (1988), which emphasizes reliability, responsiveness, assurance, and empathy as core dimensions shaping perceived service quality. Students tend to view administrative services that are fast, accurate, and communicative as reflections of strong institutional performance. This aligns with (Fitriani et al., 2021) who found that effective administrative services enhance trust and satisfaction among users of higher-education services.

Furthermore, the positive effect of operational efficiency on student satisfaction shows that work processes that are swift, well coordinated, and low in error directly improve the student experience. This reinforces Wibowo & Handayani (2020) who argue that operational efficiency is a key determinant of user satisfaction in technology-based service systems. In the present study, a path coefficient of $\beta = 0.508$ underscores the substantial influence of efficiency on satisfaction perceptions.

Beyond these direct relationships, operational efficiency also acts as a mediator between service digitalization and service quality on the one hand and student satisfaction on the other. In other words, digital transformation and high-quality services will yield optimal outcomes only when operational processes are implemented efficiently and in an integrated manner. This supports the argument of (Prajogo & McDermott, 2011) that efficiency is a mechanism transmitting the effects of managerial innovation and service quality to organizational performance. Thus, efficiency is not merely an outcome of digitalization but also a strategic conduit linking service innovation with user satisfaction.

Conceptually, these results extend the operational management literature in higher education by affirming that increasing student satisfaction requires synergy among digitalization of academic systems, high-quality administrative services, and institution-level operational efficiency. Accordingly, university management should strengthen the integration of digital systems, cultivate a service culture grounded in efficiency, and expand training for administrative staff so that digital services are genuinely oriented toward student satisfaction.

CONCLUSION

This study aims to analyze the effects of the digitalization of academic services and the quality of administrative services on student satisfaction, with operational efficiency as a mediating variable at Riau Islamic University (UIR). Based on data analysis using SEM-PLS,

most of the research hypotheses are supported. The digitalization of academic services has a positive and significant effect on operational efficiency but does not have a direct effect on student satisfaction. Conversely, the quality of administrative services has a positive and significant effect on both operational efficiency and student satisfaction. Operational efficiency is shown to be a mediating variable that strengthens the relationships between digitalization and service quality on student satisfaction. Thus, the research objectives have been achieved and indicate that operational efficiency is a strategic factor that bridges the success of digitalization and service delivery in creating student satisfaction.

Theoretically, this study extends the application of the Technology Acceptance Model by Davis (1989) and SERVQUAL model Parasuraman et al. (1988) to the context of digital higher education. The study demonstrates that technology and service quality cannot be separated from the efficiency of operational processes that link systems to user experience. These findings enrich the operational management literature in education by identifying the role of operational efficiency as a mechanism that strengthens the relationship between digital innovation and perceptions of student satisfaction. Accordingly, the study is not merely descriptive; it also provides empirical and conceptual contributions to models of educational service management in the digital era.

Practically, the study offers implications for university administrators to strengthen the integration of digital systems across units, enhance the competencies of administrative staff, and build a work culture grounded in efficiency and service. Universities need to leverage digitalization not only as an administrative tool but as a managerial strategy oriented toward continuously improving service quality and student satisfaction. This approach will help educational institutions achieve operational efficiency while building a competitive advantage based on digital services.

This study is limited by its focus on a single university, so the findings cannot yet be generalized to all higher-education institutions in Indonesia. Future research is recommended to expand the setting to multiple universities with different characteristics and levels of digitalization. Subsequent studies may also incorporate variables such as digital literacy, organizational support, or user experience to obtain a more comprehensive understanding of the factors influencing student satisfaction in the era of digital transformation.

As a final affirmation, this study concludes that operational efficiency is a strategic bridge between the digitalization of academic services and student satisfaction. These findings reaffirm that the success of digital transformation in higher education depends not only on technology but also on the institution's ability to manage work processes effectively, in an integrated manner, and with a focus on delivering added value for users of higher-education services.

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