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Research Article

Assessing the Role of AI and Human Service Quality in Enhancing Student Satisfaction and Loyalty in the Educational Sector

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ABSTRACT

The integration of Artificial Intelligence (AI) and human-driven services in the educational sector is transforming service delivery, significantly impacting student satisfaction and loyalty. This study explores the balance between AI-enabled and human service quality in enhancing student experiences within Arts and Science Colleges in Coimbatore City. A structured questionnaire was administered to 200 students aged 18–25, capturing insights on AI Service Quality (AISQ), Human Service Quality (HSQ), Student Satisfaction (SS), and Student Loyalty (SL). Using Structural Equation Modelling (SEM), the findings reveal that AISQ and HSQ positively influence SS and SL, with HSQ demonstrating a stronger impact. SS emerges as a critical mediator, explaining 65% of the variance in SL, underscoring its pivotal role in fostering loyalty. AISQ contributes to operational efficiency and personalization, while HSQ strengthens emotional connections through empathy and responsiveness. The results highlight that educational institutions must strategically integrate AI technologies with human-centric approaches to achieve optimal satisfaction and loyalty outcomes. These findings offer valuable implications for leveraging AI and human resources as complementary assets to enhance service ecosystems in higher education.

Keywords: AI Service Quality (AISQ), Student Satisfaction (SS), Human-Centric Education

Introduction

Artificial Intelligence (AI) and robotics are rapidly transforming various sectors, including education, by reshaping service delivery and enhancing user experiences. Educational institutions are increasingly adopting AI-driven tools to improve service quality, streamline administrative functions, and provide personalized learning experiences. This trend underscores the need to assess the balance between AI-driven services and human interaction in enhancing student satisfaction and loyalty.

The educational sector operates in a competitive and technologically dynamic environment, striving to meet the evolving needs and expectations of students. Similar to industries like hospitality, where service quality significantly

influences customer satisfaction and loyalty, the quality of academic and non-academic services in education profoundly affects students' perceptions and their long-term association with an institution. The integration of AI technologies—such as virtual assistants, chatbots, and adaptive learning systems—promises to revolutionize institutional interactions and support for students. However, the human element in service delivery, including empathetic communication and personalized attention, remains vital for building trust and emotional connections.

Striking the right balance between AI and human interaction is critical in creating a holistic service ecosystem in education. Studies have shown that AI-powered tools can provide personalized learning experiences tailored to individual students' needs, learning styles, and abilities, thereby enhancing student satisfaction. For instance, the development of AI-enabled intelligent assistants has been shown to enhance student learning outcomes, engagement, and satisfaction by providing personalized and adaptive learning support(Sajja et al., 2024) However, human interaction remains essential, as it has been found to positively influence student satisfaction and engagement (Surya Bahadur et al., 2024)

This study aims to evaluate the respective roles of AI and human service quality in fostering student satisfaction and loyalty, providing valuable insights for institutions seeking a competitive edge in a technology-driven educational landscape.

Review of Literature

The integration of Artificial Intelligence (AI) into service industries, including education, has become a critical focus for researchers and practitioners. Drawing parallels from (Sardesai et al., 2024), whose study explored the hospitality sector, it is evident that AI and Human Service Quality (HSQ) significantly influence customer satisfaction (CS) and loyalty (CL). This framework can be effectively adapted to the educational sector to understand its implications on student satisfaction and loyalty.

AI in Service Quality

AI is increasingly used to emulate human cognitive functions, such as learning and problem-solving. In the hospitality sector, (Sardesai et al., 2024)emphasized the transformative role of AI in enhancing service quality by automating routine tasks, analysing customer data for personalization, and improving operational efficiency. Similarly, in education, AI-powered learning systems can provide personalized learning experiences, offering tailored content and real-time feedback, thereby enhancing student satisfaction. (Yang et al., 2020) highlighted how service robots in hospitality improve customer experience by providing consistent and reliable service. Translating this to education, AI-enabled tools, such as virtual tutors and chatbots, can serve as reliable and scalable resources for students, reducing dependency on human faculty while maintaining service quality. However, the study also warns of potential drawbacks, such as reduced human interaction, which could impact the emotional and interpersonal dimensions of service delivery (Huang & Rust, 2021).

Human Service Quality (HSQ) and Its Role

Human Service Quality, as defined by (Parasuraman et al., 1985), involves dimensions such as reliability, empathy, and responsiveness. (Sardesai et al., 2024) highlighted that despite the efficiency of AI, the human touch remains critical in ensuring customer loyalty. In the context of education, faculty members' ability to address students' emotional and academic needs is pivotal. (Prentice & Nguyen, 2020) confirmed that while AI services improve operational efficiency, human service quality fosters deeper engagement and loyalty. Furthermore, (Sardesai et al., 2024) observed that customer satisfaction mediates the relationship between HSQ and CL, often to a greater extent than AI service quality (AISQ). Applying this insight to education suggests that while AI can optimize administrative and academic processes, the faculty's human interaction will likely have a stronger influence on student loyalty.

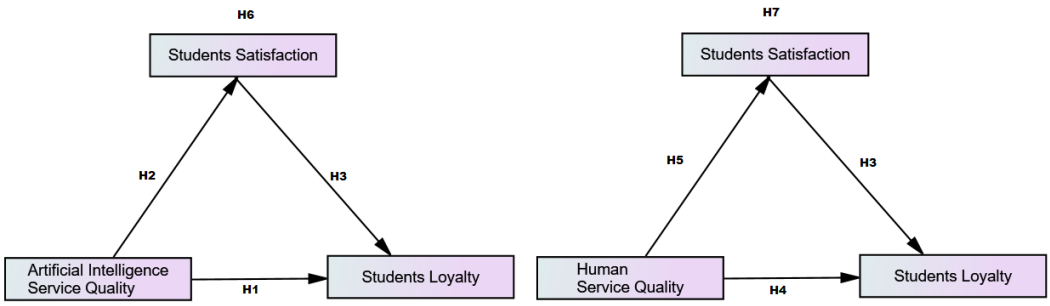
Customer Satisfaction and Loyalty

Satisfaction and loyalty are intrinsically linked to service quality. (Sardesai et al., 2024) found that high AISQ and HSQ lead to increased satisfaction, which in turn fosters loyalty. In education, satisfaction can be linked to various factors, such as the quality of course delivery, availability of resources, and responsiveness of faculty and support staff. As (Kabu Khadka & Soniya Maharjan, 2017) observed, understanding the interplay between satisfaction and loyalty is essential to ensure that students not only achieve academic success but also develop a positive affiliation with the institution. Studies by (Vu & Nguyen, 2022) and (Mishra, 2022) further emphasized that the intention to

reuse or recommend services is significantly influenced by satisfaction. These findings align with (Sardesai et al., 2024),who demonstrated that satisfaction mediates the relationship between AISQ, HSQ, and CL. Thus, institutions need to balance the adoption of AI technologies with human-centric approaches to achieve optimal satisfaction and loyalty outcomes.

Theoretical Framework and Hypotheses

(Sardesai et al., 2024) leveraged the Resource-Based Perspective Theory to argue that organizations with unique resources and capabilities are better positioned to innovate and enhance service delivery. In education, institutions can similarly utilize AI and human resources as strategic assets to differentiate themselves and improve student outcomes. Building on (Sardesai et al., 2024) the following hypotheses are proposed for the educational sector **H1**: AISQ positively and significantly impacts SS, **H2**: AISQ positively and significantly impacts SL, **H3**: CS positively and significantly impacts SL, **H4**: HSQ positively and significantly impacts SS, **H5**: HSQ positively and significantly impacts SL, **H6**: SS mediates the relationship between HSQ and SL, **H7**: SS mediates the relationship between AISQ and SL, and **H8**: SS mediates the relationship between HSQ and SL to a greater extent than AISQ and SL.



H8: H7>H6

Figure 1 : Proposed model (Sardesai et al., 2024)

Research Methodology

The study collected data through Google Forms from July to November 2024, targeting 200 students from Arts and Science Colleges in Coimbatore city that incorporate AI-enabled services in academic and administrative functions. Purposive sampling was used to select students actively engaging with AI-driven and human services, with a demographic composition of 52% male and 48% female participants, mostly aged 18–25 years. A structured questionnaire with five sections was employed, using a 5-point Likert scale to gather insights on various constructs.

The quality of AI-enabled services (AISQ) was measured using a 10-item scale adapted from (Gao & Liu, 2023), focusing on attributes such as usability, reliability, and personalization. Human service quality (HSQ) was assessed using a 12-item scale based on (Dagger et al., 2007), emphasizing empathy, assurance, and reliability. Student satisfaction (SS) was captured through a 10-item scale adapted from (Oliver, 2014) and (Han & Hyun, 2017), highlighting the synergy between AI and human services. Lastly, student loyalty (SL) was measured using a 6-item scale adapted from (Zeithaml et al., 1996), focusing on trust, advocacy, and emotional attachment.

This comprehensive methodology integrates both AI and human-driven service dimensions to provide a robust framework for evaluating student satisfaction and loyalty in higher education institutions. The validated scales ensure reliability and relevance in addressing the research objectives.

Data Analysis and Interpretation

After assessing the validity and reliability of each construct, the measurement models were evaluated using AMOS version 21 to ensure robustness. Modification indices were analysed to identify items with significant shared variance, which were subsequently removed to enhance the model's fit. Once the measurement model demonstrated satisfactory validity and reliability, the structural model was employed to test the proposed hypotheses in the context of AI-enabled and human service quality, student satisfaction, and loyalty within educational institutions.

Table 1. Reliability of scales and Validity of measurement model

Construct	Code	Item	Factor Loading	Cronbach's Alpha	CR	AVE
AI Service Quality (AISQ)	AISQ1	Provides personalized academic recommendations	0.84	0.89	0.91	0.63
	AISQ2	Tracks attendance with accuracy	0.87			
	AISQ3	Ensures secure and smooth fee payments	0.82			
	AISQ4	Delivers timely notifications about schedules	0.85			
	AISQ5	Supports interactive learning experiences	0.83			
	AISQ6	Provides on-demand assistance	0.81			
	AISQ7	Enhances communication with institutional support	0.80			
	AISQ8	Ensures user-friendly navigation	0.86			
	AISQ9	Maintains reliability during peak usage times	0.88			
	AISQ10	Adapts to specific academic needs	0.85			
Human Service Quality (HSQ)	HSQ1	Faculty members are approachable	0.83	0.91	0.93	0.67
	HSQ2	Communication during lectures is clear	0.82			
	HSQ3	Issues are resolved promptly	0.85			
	HSQ4	Faculty understand students' goals	0.80			
	HSQ5	Examination queries are addressed	0.81			
	HSQ6	Administrative staff are supportive	0.84			
	HSQ7	Faculty are available for mentorship	0.85			
	HSQ8	Faculty expertise is evident	0.87			
	HSQ9	Grievances are addressed promptly	0.83			
	HSQ10	Students are treated equally	0.84			
	HSQ11	Non-teaching staff are approachable	0.82			
	HSQ12	Institution is committed to excellence	0.86			
Student Satisfaction (SS)	SS1	AI tools enhance academic performance	0.84	0.88	0.90	0.62
	SS2	Faculty engage in extracurricular activities	0.81			
	SS3	Updates are provided timely	0.85			
	SS4	Adequate resources are available	0.83			
	SS5	Support systems are accessible	0.82			
	SS6	AI improves academic outcomes	0.85			
	SS7	Teaching processes are high quality	0.87			
	SS8	Infrastructure is satisfactory	0.84			
	SS9	Fees provide good value	0.83			
	SS10	Overall services are satisfactory	0.86			
Student Loyalty (SL)	SL1	Will recommend the institution	0.88	0.87	0.89	0.62
	SL2	Intends to enroll in further programs	0.85			
	SL3	Promotes the institution positively	0.83			
	SL4	Relies on AI post-graduation	0.84			
	SL5	Trusts the institution's vision	0.86			
	SL6	Remains loyal despite competitors	0.82			

Source: Primary data

Note: CR- composite reliability; AVE – Average variance extracted

Structural Equation Modelling Results

From Table 2, it is evident that AISQ explains 15% of the variance in SL, whereas HSQ explains 20% of the variance in SL. AISQ explains 18% of the variance in SS, while HSQ explains 28% of the variance in SS. Notably, SS explains 65% of the variance in SL, indicating that Student Loyalty is significantly influenced by Student Satisfaction.

This implies that colleges must prioritize both AI-enabled and human services to enhance satisfaction and loyalty among students. The results also demonstrate that the impact of HSQ on SS (.578) is greater than that of AISQ on SS (.362). Similarly, the impact of HSQ on SL (.452) surpasses the impact of AISQ on SL (.375), highlighting the importance of human interaction. While AI services provide efficiency and personalization, the human element remains critical for fostering long-term loyalty.

Table 2. SEM Coefficients and the Significance

Hypothesis	Std. Estimate	S.E.	C.R.	P	R^2	Result
H1: AISQ → SL	.375	.112	3.348	***	15%	Supported
H2: AISQ → SS	.362	.095	3.811	.001	18%	Supported
H3: SS → SL	.812	.155	5.234	***	65%	Supported
H4: HSQ → SL	.452	.134	4.104	***	20%	Supported
H5: HSQ → SS	.578	.121	4.779	***	28%	Supported

Source: Primary data

*** p-value < 0.01

R^2 indicates the proportion of variance in the dependent variable explained by the independent variable.

This analysis underscores the synergistic role of both AISQ and HSQ in shaping Student Satisfaction and Loyalty while emphasizing the necessity of retaining a balance between AI-driven efficiency and the irreplaceable human touch in academic and administrative processes.

Table 3. SEM Path Coefficients and the Significance for the Mediating Effect of Student Satisfaction on the Relationship Between AISQ and SL

Path	Std. Estimate	S.E.	C.R.	P
AISQ → SL (without mediating variable)	.375	.112	3.348	***
AISQ → SL (Direct with mediating variable)	.078	.062	1.258	.209
AISQ → SL (Indirect effect with mediating variable)	.297	.007		***

Source: Primary data
**** p-value < 0.01*

From Table 3, it can be observed that initially, there is a positive and significant direct relationship between AISQ and SL (Std. Estimate = .375, p < 0.01). However, upon introducing the mediating variable, SS, the direct relationship becomes non-significant (Std. Estimate = .078, p = .209), indicating full mediation. The indirect relationship (Std. Estimate = .297) remains positive and significant at the 1% level, confirming the mediating role of SS. This aligns with Hayes (2018), establishing mediation in structural equation modelling. It can be concluded that Student Satisfaction fully mediates the relationship between AI Service Quality and Student Loyalty. This highlights the importance of satisfaction as a crucial factor in leveraging AI-enabled services to foster loyalty among students. Hence, **H6 is supported.**

Table 4. SEM Path Coefficients and the Significance for the Mediating Effect of Student Satisfaction on the Relationship Between HSQ and SL

Path	Std. Estimate	S.E.	C.R.	P
HSQ → SL (without mediating variable)	.429	.148	2.899	***
HSQ → SL (Direct with mediating variable)	.157	.088	1.784	*
HSQ → SL (Indirect effect with mediating variable)	.521	.005		***

Source: Primary data
** p-value < 0.01

*p-value < 0.10

From Table 4, it can be observed that there is an initial positive and significant direct relationship between HSQ and SL (Std. Estimate = .429, p < 0.01). When the mediating variable, SS, is introduced, the direct relationship becomes weaker but remains significant (Std. Estimate = .157, p < 0.10), indicating a partial mediation effect.

The indirect relationship (Std. Estimate = .521) is positive and significant at the 1% level, confirming the mediating role of SS. This aligns with Hayes (2018) in proving mediation in structural equation modelling. Furthermore, it can be observed that the indirect effect of SS between HSQ and SL (.521) is greater than the indirect effect of SS between AISQ and SL (.297), highlighting the more substantial role of HSQ in fostering student loyalty.

It can be concluded that Student Satisfaction partially mediates the relationship between Human Service Quality and Student Loyalty. Additionally, the stronger indirect effect of SS in the HSQ-SL relationship emphasizes the significance of human-driven services in promoting loyalty. Hence, H7 and H8 are supported.

Discussion, Limitations and future scope of the study

In comparing our study to similar published research, it becomes evident that the integration of artificial intelligence (AI) and robotics in the hospitality industry is a topic of growing interest and importance. Our study builds upon the foundation laid by previous research, such as the work of (Parasuraman et al., 1985) and (Yang et al., 2020) underscore the importance of service quality—whether AI-driven or human-mediated—in shaping customer satisfaction and loyalty.

Our findings contribute to this body of knowledge by providing empirical evidence of the impact of AI service quality (AISQ) and human service quality (HSQ) on customer satisfaction and loyalty. Consistent with the findings of (Prentice & Nguyen, 2020), our study demonstrates that both AI and human service quality significantly influence customer satisfaction. Furthermore, our research extends this understanding by revealing the mediating role of customer satisfaction in the relationship between service quality dimensions and customer loyalty, a result that aligns with the studies of (Kabu Khadka & Soniya Maharjan, 2017) and (Belanche et al., 2020)

Building upon insights from our findings and related research, several practical implications emerge for practitioners in the hospitality sector. Managers and service designers can draw on the complementary strengths of AI efficiency and human empathy, as highlighted in (Reis & Melão, 2023), to optimize customer experiences. Moreover, integrating AI solutions without undermining human-centric service aspects can help businesses address evolving customer preferences.

Our study also raises critical considerations for future research. For instance, as (Naumov, 2019) discussed, the adoption of AI in hospitality introduces complexities related to privacy concerns, communication dynamics, and overall guest satisfaction. Further exploration of these aspects, along with the long-term implications of AI integration on customer behaviour and competitive dynamics.

Despite its contributions, our study has limitations. Firstly, the sample consisted solely of Indian hotel guests who interacted with AI systems linked to these hotels, which limits the generalizability of our findings. As noted by (Naumov, 2019), geographic and cultural factors may influence customer responses to AI integration. Future research should consider replicating this study across diverse regions and cultural contexts to strengthen the external validity of the results. Additionally, while our study focused on the direct and mediated effects of AISQ and HSQ on customer satisfaction and loyalty, there are likely other influencing variables. Researchers could build on the suggestions of various authors by exploring additional dimensions of service quality, such as emotional engagement and personalization, and examining moderating factors like technological readiness and organizational culture.

Conclusion

Our study aimed to explore how students' perceptions of service quality in educational institutions vary based on interactions with artificial intelligence (AI) and human staff. Specifically, we examined the impact of both Artificial Intelligence Service Quality (AISQ) and Human Service Quality (HSQ) on student satisfaction and loyalty.

Our findings reveal a significant and positive relationship between both AISQ and HSQ with student satisfaction, consistent with prior research by (Prentice & Nguyen, 2020). Furthermore, student satisfaction mediates the relationship between both AISQ and HSQ with student loyalty. Importantly, our results demonstrate that the indirect effect of HSQ on student loyalty is stronger than the effect of AISQ, echoing the findings of (Mende et al., 2019), who emphasized the compensatory responses of consumers to humanoid service robots and their impact on service experiences.

Additionally, our study underscores a pronounced preference for human interactions among students, aligning with research by (Reis & Melão, 2023), which highlighted the importance of emotional connections in educational settings. Despite the growing use of AI-powered tools in educational institutions to enhance operational efficiency and student engagement, our findings reaffirm the critical role of human empathy in shaping positive service experiences, particularly in the context of student-centric education models.

Going forward, educational institutions need to establish a balanced integration of AI and human interactions. This requires careful evaluation of AI's efficiency and the irreplaceable value of human empathy to decide where and how to implement AI technologies in their educational ecosystem. By recognizing the potential challenges associated with over-reliance on AI and strategically aligning it with human roles, institutions can better address the expectations of students and educators alike.

This study contributes to the growing body of knowledge on the interplay between AI and human service interactions in the education sector. By emphasizing the dual importance of AISQ and HSQ in shaping student satisfaction and loyalty, the findings provide valuable insights for policymakers and educators. In line with the work of (Bock et al., 2020), which examined AI's role in personalized learning environments, our study offers practical implications for enhancing institutional performance and navigating the evolving landscape of educational innovation effectively.

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