

CHATBOT FOR EDUCATIONAL SERVICES: CONFIRMATION AND ASSESSMENT OF QUALITY DIMENSIONS

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ABSTRACT

The increased use of digital devices and integration of information technology has resulted in a rise in the development and implementation of artificial intelligence-based bots. Education sector is no exception and is actively exploiting the capabilities of chatbots for teaching and learning. Delhi University too took a leap forward in this regard by enabling its admission chatbot in the current academic session. Since research in this domain is still in its infancy, the present study was undertaken to provide an understanding of the chatbot quality and effectiveness for academic institutions. Responses obtained from 226 students who had used the admission chatbot were analyzed using the technique of CFA and SEM. The results confirm 13 dimensions of chatbot quality for educational services. Further, the performance of the admission chatbot is found to be above average for all the dimensions, indicating the scope as well as need for improvement in its quality and effectiveness, especially with respect to the dimensions of Personalization, Security, and Information Quality which have been

revealed to be exerting a significant impact on the overall experience of the users (i.e., students). The findings thus help in identifying important constituents of chatbot quality and may be used by higher education institutions and Universities to develop and integrate chatbots in teaching and learning activities to yield desired experience for students across different disciplines and courses.

Keywords: Chatbot, Quality Dimensions, User Experience, Educational Services

INTRODUCTION

The increased usage of digital devices over the years has resulted in a shift from offline to online platform. We are progressing towards an era where robotics and machine learning have made it possible to automate the human effort. This artificial intelligence-based bot, commonly known as chatbot, is becoming the next megatrend. In education sector too, Universities all over the world are experiencing changes in the way they work and are showing increased interest in exploiting the capabilities of chatbots for

teaching and learning. Technological solutions have also been developed for optimal and rapid response handling of admission enquiry system of higher education colleges and Universities. The case in point is University of Delhi that recently enabled an interactive chatbot to solve the queries of the students related to its undergraduate admission procedure, courses, fee structure and other information (The Economic Times, 2021). The application is aimed at assisting prospective students and parents on admission enquiries in a timely, reliable and efficient manner.

Though the use of conversational pedagogical agents in learning environments is not new, an understanding of this innovation is still immature. Not many studies have been undertaken on analyzing chatbot characteristics and their resultant effect on user experience. The present research aims to address this critical gap in the literature.

LITERATURE REVIEW

Dimensions of Chatbot Service Quality

The scope of tasks chatbots and virtual assistants can perform is growing rapidly, resulting in the consensus that artificial intelligence will have a pivotal role in future. At the same time, quality will continue to play a pivotal role in enhancing the acceptance and ensuring the continued use of chatbot services by customers.

Since many aspects such as consumer perceptions, service attributes and personnel, service delivery and service environment, mould the quality and effectiveness of a service (Rust & Oliver, 1994, Noor et al., 2021), previous studies laid extensive focus on identifying the same for varied service contexts including

tourism, airlines, healthcare, and education. Most dominant work in this regard has been the service quality scale, popularly known as Servqual, developed by Parasuraman et al. (1988). The five dimensions of Servqual (viz, tangibles, reliability, responsiveness, assurance, and empathy) provide an evaluation of service quality in terms of the gap between customer expectation and perception of service performance.

With advances in information technology and service innovations, organizations have changed the way they interact and provide service to customers (Ngyuen, 2019). Researchers focus to examine quality of electronic services led to the development of E-Servqual by Parasuraman et al. (2005) that further incorporated varied attributes that influence quality of e-services.

However, innovation in the form of development of artificial intelligence-based agents in the customer service domain again presented a need to revisit the Servqual model. A study was conducted by Radziwill & Benton (2017) with an aim to provide a comprehensive review of quality attributes for chatbots and conversational agents. The researchers identified three broad categories viz. effectiveness, efficiency, and satisfaction, in which the quality attributes were placed.

In another study, Guesmia et al. (2018) aimed at developing a multi-dimensional measure of perceived quality for chatbots and identified sixteen dimensions of quality. However, only four dimensions namely, visual appeal, efficiency, ease of use, coherence, and reliability could be retained and validated through PLS-SEM.

In a continuing work that involved an assessment of chatbot use on customer support, Nguyen

(2019) reported an improvement in customer experience that could be achieved due to the introduction of chatbot service. Their findings also pointed that failure to provide human support with chatbot may not necessarily worsen customer experience.

While investigating consumers' acceptance and intention to reuse a service robot and artificial intelligence-based services in airline industry, Meyer-Waarden et al. (2020) used the Technology Acceptance Model (TAM) with an added component of 'trust'. The researchers adopted service quality dimensions from the E-Servqual scale and reported reliability and perceived usefulness as most important determiners of intention to reuse the chatbot.

A similar kind of study conducted by Li et al. (2020) in the context of Chinese online travel agencies identified and investigated five dimensions of chatbot quality- understandability, reliability, responsiveness, assurance, and interactivity, for their impact on user confirmation or continuance. Except for responsiveness, the findings revealed the remaining four chatbot dimensions to be positively associated with use confirmation.

A recent work by Noor et al. (2021) has advanced the service quality model by adding dimensions specific to the context of artificial intelligence-based service agents. The researchers have developed a conceptual framework that include twelve dimensions that integrate the service quality model to the unique characteristics of chatbots and conversational agents.

The aforesaid discussion forms the basis of identifying attributes that constitute quality dimensions to evaluate chatbot services. Thirteen underlying dimensions are tested in the present

work for their validation and use as an overall diagnostic tool to assess the effectiveness of the admission chatbot of University of Delhi.

User Experience

Experience has become as important as the product or service and the onus to deliver the right and desired experience is on the firms.). While chatbots cannot replace humans, they can complement the user experience in multiple ways such as reducing the waiting time, handling initial support interactions, responding to simple enquiries, and providing human support to follow up or resolve the issue. Due to the ability of artificial intelligence-based systems to predict customer actions, chatbots hold good potential to deliver individual and personalized service experience. At the same time, any single touchpoint between customers and organizations that does not deliver the expected service results in a negative customer experience and attitude (Van de Sand et al., 2020).

Iqbal et. al. (2018) have opined that customer experience can be enhanced through the use of chatbots that are effective and effortless to use. The contact-less service of chatbot and inseparability between the customer and the technology (Curran & Meutr, 2005), the interaction is unique and provides an experience that is evaluated by consumers as being favourable or unfavourable, positive or negative, good or bad, pleasant or unpleasant (Djelassi et al., 2018).

Despite the increasing use of chatbots in services, not much research has been conducted on user experience for this application area. The present study is an attempt to fill this void in literature.

OBJECTIVES

The study aims to:

1. Identify and confirm the quality dimensions for chatbot in educational setting
2. Assess the performance of Delhi University admission chatbot on various quality dimensions, and
3. Examine the impact of chatbot quality on user (or students') experience.

METHODOLOGY

The study used secondary data sources to structure and integrate the existing literature in the area of information systems, use, design, and implementation of chatbots. Using an online questionnaire, primary responses were collected (1-15th January, 2022) from those students who had used the University's admission chatbot at the time of applying for admission in the current academic session.

Through three sections of the questionnaire, information was sought on applicants'

background and demography, their assessment of the effectiveness of the admission enquiry chatbot on various characteristics, and the applicants' response outcome in form of their overall user experience with the chatbot application. The measures have been borrowed from previous studies and were modified to suit the context under study. All responses were obtained on a seven-point Likert scale. The final data obtained from 226 students was analyzed using AMOS 20.0 software.

VALIDITY AND RELIABILITY OF MEASURES

Reliability of the data set was established from the cronbach alpha values and composite reliability scores. Values above 0.70 for all the measures establish reliability of the data set. Further, the standardized loadings above 0.70, values of average variance extracted more than 0.50 pointed towards the validity of measures used in the present work.

Table 1: Measures Used in the Study

Construct	Description	Coding	No. of Items	Factor Loadings	Alpha
Reliability	Performing services dependably and accurately	RL1	4	.768	0.913
		RL2		.807	
		RL3		.839	
		RL4		.837	
Responsiveness	Prompt response and speedy resolution of problem	RS1	4	.813	0.919
		RS2		.804	
		RS3		.819	
		RS4		.860	
Availability	Accessible anywhere and anytime	AV1	2	.844	0.854
		AV2		.828	

Aesthetics	Appeal and clarity of interface design	AE1	2	.748	0.781
		AE2		.781	
Personalization	Individual and personal attention	PI1	4	.839	0.928
		PI2		.803	
		PI3		.854	
		PI4		.890	
Security	Safety and privacy	SE1	3	.913	0.943
		SE2		.882	
		SE3		.912	
Control	User control of the process or outcome	C1	3	.851	0.937
		C2		.948	
		C3		.889	
Ease of Use	Free of effort	EA1	3	.847	
		EA2		.874	
		EA3		.870	
Enjoyment	Perceived enjoyment from the use	EN1	3	.907	0.942
		EN2		.914	
		EN3		.877	
Contact	Provision of human support	U1	3	.864	0.921
		U2		.828	
		U3		.889	
Proactiveness	Providing services beyond prescribed commands	F1	5	.784	0.949
		F2		.913	
		F3		.883	
		F4		.865	
		F5		.863	
Humanity	Presence of human-like features or emotions	H1	3	.898	0.918
		H2		.895	
		H3		.770	
Information Quality		IQ1	5	.852	0.960
		IQ2		.915	
		IQ3		.931	
		IQ4		.873	
		IQ5		.903	

Overall Experience	Outcome of the interactions, systems and processes	O1	3		0.942
		O2			
		O3			

ANALYSIS AND FINDINGS

Identification and Confirmation of Chatbot Quality Dimensions

Extensive literature review in the area of service quality helped in identifying major attributes and dimensions of quality of chatbot services. Using CFA in AMOS 20.0, the study confirmed 13 dimensions of chatbot quality (see Table 1). The fitness indices within the acceptable range (CMIN/DF=2.766, GFI= .701, NFI=.847, TLI= .880, CFI= .895, RMSEA= .089, LO 90=.084, HI 90=.093) support a good model fit.

THE STRUCTURAL MODEL

The structural model (Figure 1) was prepared to assess the direct impact of each of the thirteen dimensions. As the fit indices (CMIN/df=4.420, NFI=.665, TLI=.685, CFI=.717, RMSEA=.123) are in the acceptable range, the results support a reasonable model fit.

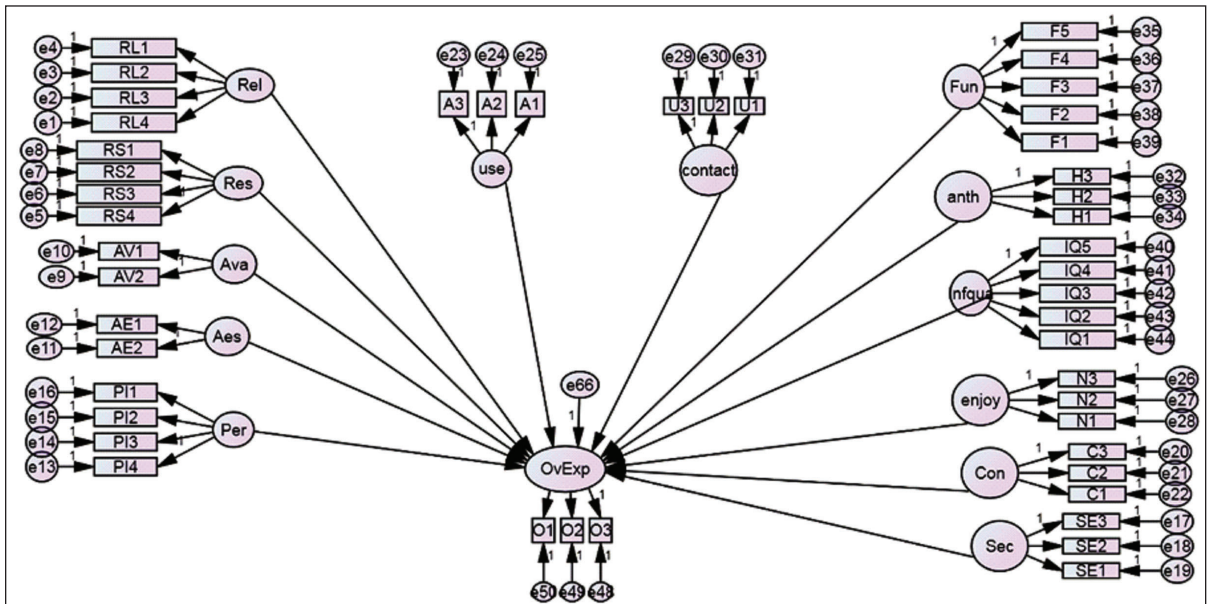


Figure 1: The Structural Model

RL: Reliability (Rel), RS: Responsiveness (Res), AV: Availability (Ava), AE: Aesthetics (Aes), PI: Personalization (Per), SE: Security (Sec), C: Control (Con), A: Ease of Use (Use), N: Enjoyment (Enjoy), U: Contact (Contact), F: Proactiveness (Fun), H: Humanity (Anth), and IQ: Information Quality (Infqual).

IMPACT ASSESSMENT AND MEAN PERFORMANCE

Each of the thirteen dimensions of chatbot quality were examined for their impact on the overall experience of the users. The results in Table 1 indicate significant influence of only three dimensions (namely, Personalization, Security, and Information Quality) on different response outcomes. Of these dimensions, information quality is found to be most significant aspect (Beta=.866), followed by personalisation in affecting the user experience in a positive direction. Further, 'security' is found to exert a negative impact on user experience.

Table 2: Impact Assessment and Mean Scores

			Beta	Sig.	Mean
OvExp	<---	Reliability	-.219	.648	4.4690
OvExp	<---	Responsiveness	.442	.377	4.7445
OvExp	<---	Availability	-.680	.173	4.6372
OvExp	<---	Aesthetics	.577	.227	4.4181
OvExp	<---	Personalization	.301	***	4.5321
OvExp	<---	Security	-.191	***	4.6917
OvExp	<---	Control	.025	.639	4.5988
OvExp	<---	Ease of Use	-.347	.134	4.5383
OvExp	<---	Enjoyment	-.069	.187	4.6386
OvExp	<---	Contact	.486	.040	4.5634
OvExp	<---	Proactiveness	-.391	.236	4.6779
OvExp	<---	Humanity	.251	.442	4.6652
OvExp	<---	Information Quality	.866	***	4.6434
Overall Mean					4.5015

(Source: Data Analysis)

However, though the mean scores are encouraging, the performance is below the maximum score of 7 (on a seven-point Likert scale), thus indicating the scope for improvement in University's admission chatbot. The performance is found to be highest in respect of its 'responsiveness' followed by 'security'. Quite ironically, the chatbot is performing well on responsiveness- a dimension that is not exerting any significant influence on students' use experience. At the same time, high security feature is resulting in a negative experience concerning the use of the chatbot.

CONCLUSION AND IMPLICATIONS

The present study makes a makes a useful contribution to the field of research by addressing the need and examining the chatbot attributes that can streamline interactions between students and administration. The findings reveal the effectiveness of the thirteen quality dimensions of the admission enquiry chatbot in yielding desired user experience.

However, the results point out towards the need to introduce necessary changes in the chatbot application to improve and update the existing chatbot application in accordance with the information and quality sought by the users. First, it would be more appropriate to shift focus from general to specific information needs across disciplines and courses offered. This will help the University to develop a better connect and have a clear view of the admission-related problems faced by the students. Second, an occasional lack of performance on an attribute may not necessarily produce a bad experience. Proactive approach and assistance of human representatives at the point of action can supplement chatbot's efficiency and ability to handle enquiries. Third, the dual approach of having conventional methods along with chatbot application can be effective in catering

to a widened base of students and providing them with a provision of staying connected at all times. Lastly, it is important that the interactive systems and chatbot applications are regularly assessed and evaluated to ensure that they provide consistent utility and desired experience of use.

In sum, the insights from this work can be used by higher education institutions and Universities to develop and integrate chatbots in teaching and learning activities across different disciplines and courses.

LIMITATIONS AND FUTURE SCOPE

The gaps of the study will pave way for future research in this evolving domain. Researchers can empirically validate the quality dimensions for chatbot applications in varied service contexts and examine each of the dimensions for its impact in generating different groups of experience viz., positive-negative, learning-oriented, and engagement-oriented. Inclusion and assessment of other outcome variables such as satisfaction and intentions to use, may provide further interesting insights. Lastly, an investigation into the design-based and model-based perspective of user experience would be relevant to chatbot research and development.

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