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DEVELOPMENT OF SERVICE QUALITY SCALE IN ONLINE HIGHER EDUCATION

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Abstract
The aim of the paper is to develop a valid and reliable service quality tool in the context of online higher education in Pakistan. For this purpose, an extensive literature review has been done followed by an expert opinion to develop the initial scale of service quality. Data has been collected from 480 students enrolled in universities offering online degree programs. Further, Confirmatory Factor Analysis has been done by using AMOS for scale refinement through empirical tests. Nine dimensions of service quality were identified from literature in the context of online higher education in Pakistan. The research concludes that service quality scale with nine dimensions and fifty-five items is a valid scale for this study. The study highlighted the areas which need improvement to increase the overall effectiveness of the online higher education model. This paper developed a tool to measure service quality in the online higher education sector.

Key Words: Online Higher Education, Service Quality, Scale Development
JEL Codes: H75

I. INTRODUCTION

The service industries are considered to play a significant role in the economy of many countries around the globe. The increased competition in the global market has made "quality service" as the key to success. With the passage of time, the increased usage of internet has increased the competition in "accessing, communicating and persuading customers to buy and use the service" (Fernández-Cavia et al., 2014; Ostovare & Shahraki, 2019). It has enlightened the significance of service quality in online higher education institutes as well. Such transformation has increased the "commercial competition" among the online higher education institutes due to the impact of different economic factors. According to Angell et al. (2008), there is a linkage between the expectations of the customers and its influence as well as loyalty in the setting of higher education. It has been observed that many Asian universities are still facing issues in gaining the satisfaction as well as loyalty of the students but they are still focusing on their quality services (Yeo & Li, 2014). This has encouraged many online higher education institutions to improve their service qualities. In Pakistan many universities are offering e-learning programs to the students to compete with the global world. Some of these universities include: "Allama Iqbal Open University (AIOU), Virtual University of Pakistan., Preston University, COMSATS University and University of Peshawar". Such institutes are also focusing towards improving the service quality in online higher education to gain more customers. This showed the significance of developing a Service Quality Scale in Online Higher Education institutes in Pakistan for effective competitiveness considering the "website SQ measure". However, different tools for measuring the service quality have been introduced. One of these tools was "SERVQUAL scale" that was introduced to measure the service quality of different industries (Ladhari, 2009). This scale was highly criticized as it was not comprehensive. Whereas, for the higher education institutes in Asia, "PAKSERV scale" was introduced to measure the service quality (De Jager & Gbadamosi, 2010). Many online higher education sectors in Pakistan are facing difficulties in engaging more students that resulted in increasing no. of student failures as well as dropouts. It was due to the absence of "customer-centric approach" in such institutes. This led to the transformation of the online higher education centers in Pakistan (Kashif et al., 2013). This has encouraged such institutes to focus on the service quality as well as student satisfaction (Kashif & Ting, 2014). Bhuasiri et al. (2012), considered service quality as one of the critical success factors for the success of e-learning.

The past conducted studies showed that the clarity on the conceptualization as well as testing of a "website SQ measure" was lacking especially in the online higher education sectors. The main objectives of the current study include: to summarize the existing literature on service quality and its dimensions in context of online higher education, to develop a service quality scale in context of online higher education and to establish the "construct validity" of the developed scale. Limited no. of studies was conducted on the Service Quality Scale in Online Higher Education. However, many scales have been discussed in different studies for measuring the service quality of different higher education sectors. Such scales included: "SERVQUAL scale" and "PAKSERV scale" (Brown & Mazzarol, 2009). But almost no such scale was discussed for online higher education. As the world is becoming more digitalized, the trend of online higher education is increasing day by day. This has enlightened the significance of the service quality for online higher education. The current study is found to be of great significance as it helped in academic as well as practical implications. It also supported "the service marketing theory" considering the significance of e-commerce. This study helped in increasing the literature review on the SQ of online higher education and its dimensions as well as it also helped in developing a service quality scale in online higher education that is the need of hour. This will ultimately help the online higher education sectors in gaining more customers by providing them satisfaction through service quality.

II. LITERATURE REVIEW

II.I. SERVICE QUALITY

The service quality in considered as the evaluation of a customer regarding a specific service and the extent to which it satisfied the customer and met his/her expectations (Al-Jazzazi & Sultan, 2017). Many studies showed that many organizations were of the view that the service quality plays a crucial role for the success of the company as it helps in satisfying the customers gaining their loyalty towards the company (Angelova & Zekiri, 2011). According to Rauch et al. (2015), the evaluation of a firm is done when it compares the expectations of its customers with its performance.

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Service quality is however defined as "how companies meet or exceed customer expectations". The initially published material renowned as Nordic perspective defined service quality as a function of three dimensions which were technical quality, functional quality, and image. Contrarily, Parasuraman 1988 presented a definition in which service quality was explained as a gap between perception and expectations of the customers. However, after the studies of Parasuraman 1985 & 1988, Cronin & Taylor in 1992, argued that service quality should be measured by using the customer perceptions only. They have presented the scale of SEVERPERF in which service quality was measured on the basis of perceptions. Cronin Jr and Taylor (1992), considered service quality as attitude and argued that it is an antecedent of customer satisfaction and comparatively having less impact on customer purchase intentions. Later, many service quality models were recommended by different scholars. A service quality model known as "SERVQUAL", was recommended by (Parasuraman et al., 1988). This model proposed a total of ten dimensions for SQ which included: "tangibles, reliability, responsiveness, competence, courtesy, credibility, security, access, communication and understanding the customer". Such model was largely used by different banks to determine the satisfaction of the customers. However, the "SERVQUAL" model consists of 5 dimensions of SQ which included: "reliability, responsiveness, assurance, empathy, and tangibles". Many scholars suggested that these dimensions played a significant role in filling the gap of the service quality which implies that "there is a difference between the expectations of customers and perception of services" (Parasuraman et al., 1991). Therefore, the current study is based on the perceptions of the students regarding service quality in online education supporting Taylor's point of view that service quality is an antecedent of service quality and should be measured as an attitude.

II.II. E-SERVICE QUALITY

The increase use of internet has led to a "cultural shift" (Lee & Lin, 2005). Even though the development in e-commerce has decreased the barriers to reach the customers but it has also increased the competition between different e-commerce organizations to gain more customers. For this purpose, the "higher service quality" is required that leads to "favorable behavioral intentions" (Brady & Robertson, 2001). Many research studies have been conducted to determine the dimensions as well as attributes to measure the e-SQ. A study was conducted by (Dabholkar, 1996), to examine the formation of customers' expectations on technology due to "self-service quality". The e-service quality attributes suggested by him because of the conducted study included: "speed of delivery, ease of use, reliability, enjoyment, and control". Many SQ models were designed for the online businesses. One of these famous models was "WebQual™". It was developed by (Barnes & Vidgen, 2002; Loiacono, 2000). The main purpose of this scale was to analyze the websites that sold books, airline tickets, hotel reservations and music. The dimensions of this scale included: "informational fit to task, interactivity, trust, response time, ease of understanding, intuitive operations, visual appeal, innovativeness, flow (emotional appeal), consistent image, on-line completeness, and better than alternative channels". A new scale was also devised by (Barnes & Vidgen, 2002) known as "WebQual". This scale was used to focus on the significance of "easy-to-use websites". Other e-service quality models included: "eTailQ" introduced by (Wolfinbarger & Gilly, 2003), "E-S-Qual" perceived by (Parasuraman et al., 2005), and "the latest hierarchical model of e-service quality" proposed by Blut et al. (2015). The e-service quality still faces different issues related to its measurement. Blut (2016), stated that both "E-S-Qual" and "eTailQ measurements" are unable to measure the dissatisfaction of the online customers and their need to move to other online stores showing disloyalty. Even the "eTailQ" is found to rank at the eighth number in its "predictive ability" but its performance is not found to be of great significance in measuring the "customer service" as well as "security". The current study helped in determining different e-service quality models for online businesses to determine their performance for measuring the online customer satisfaction.

II.III. SERVICE QUALITY IN HIGHER EDUCATION

The "higher education literature" as well as the "service marketing theory", supported the role of students in co-creating the service quality. Many scholars were of the view that students were the partners in the education system (Clayson & Haley, 2005; Ferris et al., 2002; Kotzé & Du Plessis, 2003). Many studies showed that students of higher education are more likely to establish their own "service experience" by gaining knowledge and interacting with other students or teachers. Many SQ models were developed to fulfill the needs of such models in HE sectors. Some of such SQ models included: "HEdPERF" developed by (Abdullah, 2005) and "HiEdQUAL" developed by (Annamdevula & Bellamkonda, 2012). According to Abdullah (2006), "HEdPERF" was found to have higher scores of both validity as well as reliability in comparison with "SERVPERF". A research study was conducted by (Brochado, 2009) to examine the performance of "five SQ scales in higher education". These scales included: "SERVQUAL, weighted SERVQUAL, SERVPERF, weighted SERVPERF, and HEdPERF". The capabilities of these scales in measurement, were found to be higher. The findings of the study showed that both "SERVPERF" including "reliability, assurance, tangibles, empathy and responsiveness", and "HEdPERF", including "academic aspects, non-academic aspects, reputation, access", were found to have the highest scores. The "HiEdQUAL scale" consisted of five main dimensions which included: "administrative aspects, academic aspects, support services, campus infrastructure, and academic facilities". Whereas, Sultan and Wong (2013), stated three dimensions of SQ in HE which included: "academic, administrative, and facilities". However, according to many scholars the "marketing communication" with the HE students is considered to play a vital role in perceiving the service quality. "HEI SQ" was measured by (Abd Manaf et al., 2013) in Malaysia. For this, seven dimensions were considered which included: "administrative service, tangibles, academic programs, academic staff, and delivery of teaching, assurance, and empathy of academic staff". The conducted studies showed that "HiEdQUAL" is the most effective SQ model that could be used for the measurement of service quality in higher education (Annamdevula & Bellamkonda, 2012).

II.IV. SERVICE QUALITY IN ONLINE HIGHER EDUCATION

Online higher education can be defined as an integrated process of learning & teaching with the help of information & communication technologies. In the new knowledge economies, Universities which were once responsible to train a few numbers of people are now supposed to provide professional guidance to the potential audience throughout their career. Because of Globalization and automation, number of jobs have been decreased all over the world which puts a pressure on universities to provide required diverse workforce to the society. Cost effectiveness, improving access to education & empowerment of learner are the benefits which can be derived from online higher education as stated by (Zhao, 2003). However, despite having such benefits studies highlighted certain issues which create major problems in online higher education models. Technical issues, unavailability of resource persons, limited interaction with instructors, difficult to change the course contents and absence of individualized services are the problems reported by (Zhao 2003). The progressing "e-learning environment" has considered the students as the customers of the universities and the main aim of the universities is to satisfy its students (Lee, 2010). For the satisfaction of its students, the universities should understand the attributes of "e-learning service quality" that are perceived by the students. After this, the universities should implement the required actions to enhance the "e-learning service quality" to satisfy the students. Many studies have introduced different attributes for "e-learning service quality". Such attributes included: "course design" (Kuo et al., 2014; Moore & Kearsley, 1996); "interactions between students and instructors" (Bolliger, 2004; Lee et al., 2011; Paechter et al., 2010; Sher, 2009); "interactions between students and students"; "technology-related" (Pituch & Lee, 2006; Selim, 2007); and "support and administrative services" (Levy, 2007; Weaver et al., 2008). Hassanzadeh et al. (2012), presented a model to measure success of e-learning in universities and identified service quality as important indicator in student satisfaction. They have used

responsiveness, guidance services, course management, and speed of provided services and to what extent user's views are reflected in system design and development as dimensions of service quality. Tanrıkulu et al. (2010), claimed that usability and accessibility are the most important determinants of success of online education. Senthilkumar and Arulraj (2011), considered academic factor and teaching methodology respectively as the core determinant of service quality in higher education.

II.V. SERVICE QUALITY IN ONLINE HIGHER EDUCATION IN PAKISTAN

The online higher education is considered to be effective mostly in the countries which are advanced digitally (Basilaia & Kvavadze, 2020). This is one of the reasons that it is found to be ineffective in Pakistan. Most of the operations related to education as well as administrative, are handled manually in Pakistan (Salam et al., 2017). No internet connections with fast accessibility and reliability are available in the rural areas of Pakistan that also not supported the online education in Pakistan (Wains & Mahmood, 2008). Apart from such challenges many private as well as public institutes in Pakistan have taken initiatives to introduce their online programs. Such universities include: "Allama Iqbal Open University (AIOU), Virtual University of Pakistan., COMSATS University" and many others. However, the adoption of ICT is very important for higher education, and it is impossible to ignore such technologies at higher level of education. Therefore in Pakistan, limited budget is provided for the ICT (Abbas et al., 2017). This leads to limited funds for new technologies in the education sectors of Pakistan. The crisis of Covid-19 changed the whole scenario. Due to the outbreak of covid-19, social distancing was made the new norm and the lockdown was instilled. All the Pakistani schools as well as universities were shut down and the universities were guided to use the "e-learning and management systems to conduct online classes" (Ali, 2020). A few of studies were conducted to determine the "challenges" as well "opportunities" related to e-learning for higher education during pandemic in Pakistan. The perspectives of different stake holders were considered for such studies. According to Mailizar and Fan (2020), the opinions of the students of higher education should be considered for e-learning in order to provide better service quality. Many studies showed that the e-learning programs are quite limited in Pakistan due to a no. of reasons and however, no proper service quality is observed in online higher education in Pakistan. This prevented the students from getting better education and it also not satisfy the students. This is the reason why the no. of dropouts and failures are increasing in the online institutes of Pakistan (Ahmad & Ingle, 2011). Summarization of literature reveals the fact that no uniform scale and dimensions have been used for measuring service quality in online higher education. Therefore, to develop scale, we have selected dimensions from the literature of higher education and service quality of online portals.

II.VI. SCALE DEVELOPMENT AND VALIDATION

The main objective of this study was to develop a scale for evaluation of service quality of online programs offered by HEIs. Thus, in consideration of the objectives of the study the methods recommended by MacKenzie et al. (2011) and Churchill Jr (1979) were adapted. The method combines the quantitative and qualitative research and includes of a two-stage data collection process. The development and validation process for the e-service quality in online programs scale is illustrated in figure 1. The stages and processes of data collection have been discussed in the following sections.

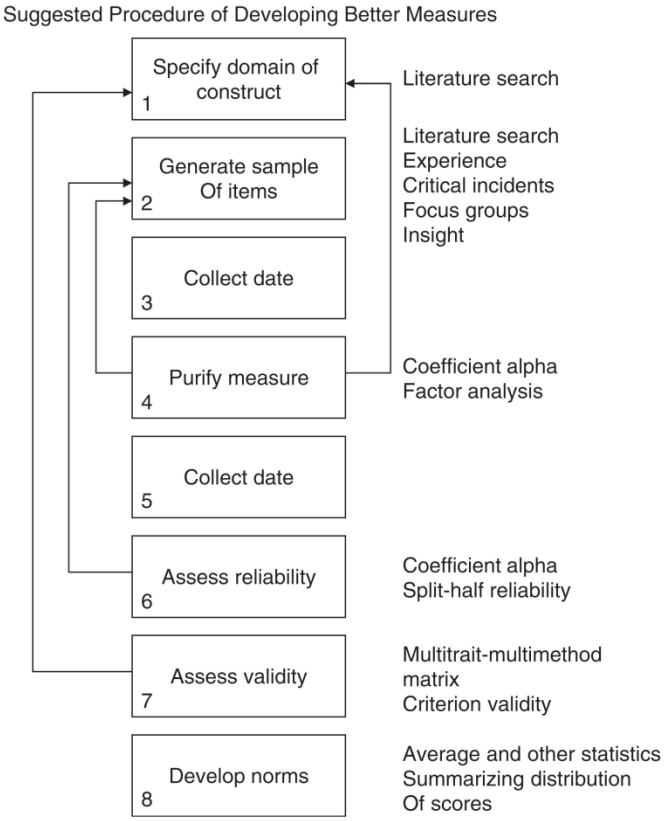

Figure 1: Procedure for scale development and validation

Source: (Churchill 1979)

II.VII. CONTENT ANALYSIS

Based on the guidelines of Churchill Jr (1979) and Diamantopoulos and Winklhofer (2001), a literature review based on the evaluation of service quality of online education was performed. Based on the review a total of 8 dimensions of the online education service quality were identified and defined. To explore the validity of these dimensions the researcher performed 10 individual in-depth interviews with a convenience sample of

lecturers and social sciences students who regularly used e-services or were taking online classes. A saturated sampling and data collection technique was used i.e., the interviews continued till no further information was being gained from the respondents (Miles & Huberman, 1994). The researcher asked the interviewees to define the service quality of education and for online graduate, skills, and undergraduate programs and identify examples of desirable features. Each interview lasted between 30 and 50 minutes. Content analysis was used for the evaluation of the responses and results suggested that the 8 proposed dimensions represented the student perspective of the SQ of online education programs.

II.VIII. ITEM DEVELOPMENT AND GENERATION

Based on the baseline theory and the prominent research on the SQ of online education programs (Beqiri et al., 2009; Bhuasiri et al., 2012; Demir et al., 2020; Farrero et al., 2010; Hawawini, 2011; Martin et al., 2021; Pham et al., 2018; Shahzad et al., 2021; Uppal et al., 2018) an initial pool of 37 items was developed. For the assessment of content validity of these items and for the generation of new items, 20 individual interviews were conducted with the university lecturers and students who had taken online classes or were interested in the possibility of complete online curriculums. Again, the method of saturated data collection and sampling was followed, and the interviews continued till the researcher felt that no further insight in the curriculum, website design and student perspectives of the notions of SQ were gained. Items that 25% or more respondents considered as inappropriate were dropped (Tian et al., 2001). The interviews were completed on the format of semi-structured interviews and were conducted by the researcher and an assistant at different higher educational institutes of Pakistan. Each interview lasted 50 minutes approximately. 20 additional items were suggested by the participants and one dimension based on 3 items was suggested by the researcher, increasing the total number of items to 60. To ensure the content and face validity of these measures' expert opinion was sought from the senior faculty members of Virtual University of Pakistan. The questionnaire was discussed with four experts in separate sittings and as per their opinion 4 statements of different items were restated to increase the comprehension of respondents. Three items were deleted as there was a consensus among the experts that suggested respondents are not suitable for giving response against these statements. The researcher contacted the students enrolled in online degree programs offered by the Universities in Pakistan. The institutes currently offering such programs include "Allama Iqbal Open University (AIOU), Virtual University of Pakistan., Preston University, COMSATS University and University of Peshawar". The study's questionnaire including the scale items were available in Urdu and English. Two well-known translators were hired for performing the back-translation method. The translated versions were cross-checked until the researcher and translators agreed on the final version of the questionnaire (Triandis & Brislin, 1984). Moreover, a pilot test was conducted to verify the language versions of the questionnaire. Several questions were adjusted based on the feedback of university and college students. The preliminary scale consisted of 57 items representing 9 dimensions of online education/courses service quality. These items were measured on a five-point Likert scale ranging from (1) "Strongly disagree" to (5) "Strongly agree".

II.IX. SCALE REFINEMENT AND PURIFICATION

An exploratory analysis was conducted for purification of the scale items (Bolton, 1993; Churchill Jr, 1979). The present study focuses on the perception of service quality of online education programs offered by the virtual universities or campuses of Pakistan and therefore in this stage the analysis and data analysis were focused on the respondents who were either current students at or had graduated from the "Allama Iqbal Open University (AIOU), Virtual University of Pakistan., Preston University, COMSATS University and University of Peshawar". Using a convenience sample, student coordinators from both institutes were requested to disseminate the questionnaire to the eligible respondents. The convenience sampling method was applied as there was no sampling frame available to randomize the respondents as the universities didn't agree to provide student information (Saunders et al., 2009). The sample size was based on the previous relevant studies and statistical rules of the proposed analytic procedure (Aaker et al., 2008). A relevant scale development study from the service industry conducted by Martin et al. (2021) obtained data from 222 respondents and Seiders et al. (2007) obtained data from 119 respondents. Moreover, as the technique of EFA, exploratory factor analysis would be used for the analysis of the data a minimum of 100 respondents was sufficient (Gorsuch, 2014). Thus, the estimated sample size for the exploratory phase was 150. The data collection process was completed over 2.5 months during which 140 questionnaires were returned. 3 questionnaires were removed due to presence of outliers, resulting in an effective sample of 137. EFA and reliability analysis were then used for the analysis of the data. The reliability analysis was performed using the latest version of SPSS software. The Cronbach alpha coefficient for each of the 9 dimensions (table 1) were all greater than the threshold of 0.7 (Hair, 2009).

Table 1: Reliability of constructs

Sr. No	Dimension	Cronbach's Alpha
1	Course design	.834
2	Course delivery	.902
3	Assessment	.793
4	Learner support services	.776
5	Registration support	.929
6	Student engagement and support	.840
7	Functionality	.827
8	Ease of use	0.841
9	Security	0.815

Specifically, the highest value was 0.929 (registration support), followed by 0.902 (course delivery), 0.841 (ease of use) and 0.827 (functionality). The next step was the application of the EFA using the PAF technique with Promax rotation applied on the 57 items. de Winter and Dodou (2012) content that PAF is one of the most renowned techniques used for the estimation in EFA. Moreover, it is effective in identifying the underlying factors and dimensions with the latent constructs (Hair, 2009). The method was selected because the oblique rotation is useful for the determination of the factor structure between the data and evaluates the correlation between the identified factors (Kashif et al., 2013). The results suggest that KMO value was 0.882 and the Bartlett's test was significant ($p < .001$), demonstrating that the results garnered by EFA were valid. According to expectations 9 factors were extracted and they accounted for 70% percent of the variance. None of the factors showed weak loadings and all loadings were above the suggested value of 0.6. Thus, all 57 items were included in the next stage of scale validation.

Table 2: Scale items and loadings

Dimensions	Items	Loadings	Reference
Course design α = 0.922 CR=0.821 AVE=0.621	Student orientation is provided	0.850	(Beqiri et al., 2009; Martin et al., 2021)
	Course objectives are clearly communicated.	0.746	
	Course material is available for overview	0.704	
	Expectations relating to student participation are communicated.	0.703	
	Expectations of student's performance is communicated	0.778	
	Duration for attempt of assignments and other coursework is communicated	0.780	
	Instructor information is available	0.775	
	Instructor's response time on emails is communicated	0.793	
	An introduction and background of instructor is provided	0.782	
	Courses are designed to deliver upgraded knowledge relating to the field	0.799	New item
Course delivery α = 0.827 CR=0.852 AVE=0.521	A variety of instructional material (videos, textbook links, research papers, web resources, YouTube links for further exploration etc. are provided).	0.710	(Beqiri et al., 2009; Martin et al., 2021)
	Course information is divided into learning modules	0.756	
	Clear instructions are available	0.787	
	Instructions are available in different languages (Urdu, English, etc.)	0.785	New item
	Access to online libraries and reading resources is available	0.777	Martin et al., 2021, Beqiri et al., 2009)
	Course activities that promote comprehension and achievement of course objectives are included	0.724	New item
	Support staff and resources are available	0.700	Martin et al., 2021, Beqiri et al., 2009)
	Accommodation for learners with disabilities (transcripts, closed captions, etc.)	0.790	
Assessment α = 0.752 CR=0.725 AVE=0.501	Assessment aligns with the course objectives	0.793	(Beqiri et al., 2009; Kashif & Ting, 2014; Martin et al., 2021)
	Inclusion of formative assessments to provide feedback on the progress of the learner	0.750	
	Rubrics for understanding marking criteria are provided	0.752	
	Assessments occur throughout the course	0.738	
	Summative assessments for evaluation of student learning	0.847	
	Graded assignments and projects are available with comments	0.716	New item
	Students can have discussion sessions with the instructors	0.723	New item
Learner support services α = 0.827 CR=0.852 AVE=0.551	Admission process, document requirements and fee structure has been communicated clearly on the website	0.720	New item
	FAQs are available on website	0.840	New item
	Admission queries are replied to in a timely manner	0.734	New item
	Course navigation is easy	0.783	(Martin et al., 2021; Pham et al., 2018; Uppal et al., 2018)
	Easily viewable media	0.799	
	The course structure is consistent	0.797	
	Media files are accessible and available on different devices	0.727	
	Technology requirements for the LMS are minimal	0.708	
	Links to institutional support services are provided	0.700	

Registration Services α = 0.712 CR=0.869 AVE=0.542	Registration schedule and process is communicated clearly on the website	0.715	New item
	Support staff replies to all queries	0.723	New item
	The students receive timely updates on their queries	0.720	New item
Student engagement and support α = 0.819 CR=0.868 AVE=0.525	Opportunities are provided to interact with the instructor.	0.840	(Beqiri et al., 2009; Brown & Mazzarol, 2009; Kashif & Ting, 2014; Pham et al., 2018; Saunders et al., 2009; Shahzad et al., 2021)
	Student-student interactions and assignments are frequent	0.734	
	Collaborative activities for supporting student learning are provided	0.783	
	Technologies facilitate active learning	0.871	
	Videos for set-up and use of LMS are provided	0.797	
Functionality α = 0.810 CR=0.844 AVE=0.575	Customizable search functions are supported by LMS.	0.727	New item
	Overall look of the LMS is attractive.	0.708	New item
	The LMS is designed to be compatible with different servers and OS	0.700	New item
	The website provides images and videos about the program and students in an intuitive and lively manner	0.738	(Bhuasiri et al., 2012; Ho & Lee, 2007; Martin et al., 2021; Shahzad et al., 2021)
	The website provides useful links for accessing program details and fee structures	0.847	
	The website provides detailed information relating to program duration, technology and system requirements and expectations from students	0.716	
	The website provides functional online payment options	0.723	
	The website includes testimonials from previous students	0.720	
Ease of use α = 0.728 CR=0.739 AVE=0.575	It is easy to search for information on the e-course or university website	0.840	(Martin et al., 2021; Pham et al., 2018; Shahzad et al., 2021)
	The layout of the e-course or university website is very clear and simple	0.734	
	It is easy to navigate on the website	0.841	
	The e-learning website is convenient to use	0.874	
Security α = 0.822 CR=0.861 AVE=0.591	The website offering online learning programs provides secure online payment options	0.754	(Fernández-Cavia et al., 2014; Kashif & Ting, 2014)
	I feel my password and personal information is protected on the online education website	0.721	New item
	The university or program website has adequate security features	0.714	New item

III. SCALE VALIDATION

III.I. PROCESS AND SAMPLE

A second study was performed to validate the dimensions of the online education program scale. The respondents included the students who were either currently enrolled in "Allama Iqbal Open University (AIOU), Virtual University of Pakistan., Preston University, COMSATS University and University of Peshawar" or had graduated within the last two years. A convenience sample was used through the usage of online data collection and leveraging the usage of social media. The data collection process took a total of 4.5 months during which time a total of 500 questionnaires were received. An evaluation of missing values and outliers removed 20 questionnaires and final analysis was performed on 480 responses. From the 480 respondents 40% were students who had graduated within the last two years and 60% were currently enrolled in programs offered by the two institutes. The sample had more male members (53%) compared to females (47%). The largest age group was those aged between 18 and 25 and accounted for 65% of the sample. The scale validation process is inclusive of the reliability analysis, EFA, CFA, and multi-group CFA. The CFA was conducted to ensure the composite reliability and construct validity of the and the multi-group CFA was performed for assessment of the invariance among the sample.

III.II. RELIABILITY ANALYSIS

The reliability analysis resulted in more robust results and the highest values were received for course design, 0.922 and 0.827 for security and learner support. Two of the items "Expectations relating to student participation are communicated" and "Instructor's response time on emails is communicated" were deleted and remaining 55 items were subjected for EFA.

III.III. EFA

The EFA estimation using the PAF and Promax rotation indicated that KMO was 0.912 and the Bartletts test was significant at the 0.001 level. These estimates confirmed the factorability of the data. Moreover, 9 factors were extracted, and they accounted for 70% of the overall variance. Thus, the values of the scale based on 55 items was deemed acceptable. The skewness and kurtosis for all items were within twice the standard error (± 1.96). Thus, the data was assumed to be normally distributed (Hair, 2009).

Table 3: Correlation coefficients

Constructs	Mean	S.D.	MSV	ASV	1	2	3	4	5	6	7	8	9
Course design	4.125	0.728	0.021	0.012	**0.721**								
Course delivery	4.421	0.716	0.045	0.015	0.121	**0.725**							
Assessment	4.083	0.731	0.065	0.023	0.107	0.111	**0.736**						
Learner support services	4.134	0.744	0.037	0.021	0.116	0.163	0.118	**0.758**					
Registration support	4.017	0.667	0.030	0.025	0.175	0.084	0.252	0.161	**0.754**				
Student engagement and support	4.508	0.880	0.067	0.065	0.095	0.187	0.265	0.149	0.198	**0.742**			
Functionality	3.214	0.777	0.067	0.022	0.138	0.082	0.077	0.171	0.115	0.238	**0.734**		
Ease of use	3.508	0.710	0.067	0.067	0.095	0.187	0.235	0.149	0.197	0.745	0.716	**0.754**	
Security	3.514	0.707	0.067	0.022	0.139	0.081	0.086	0.162	0.115	0.235	0.735	0.722	**0.798**

III.VI. CONSTRUCT VALIDITY

In the next phase, CFA using latest version of AMOS was applied for analyzing the data. First, the measurement model was established for evaluation of the model fitness. The measures of GFI, IFI, CFI, RMSEA, TLI and chi-square were used for the evaluation of the model fitness. The results indicated that $\chi 2$ /df = 1.838, GFI = 0.921, AGFI = 0.962, CFI = 0.981, TLI = 0.977, and RMSEA = 0.021. Corresponding to the suggested threshold limits as suggested by Hair (2009), it can be confirmed that the measurement model exhibited model fitness. In the next stage, the convergent, and discriminant validity were assessed. As shown in the table 2, the loadings ranged between the values of 0.7-0.9, which exceed the recommended value of 0.6 by Hair et al., 2014. The results from table 2 confirm that CR values were all greater than 0.7 and AVE values were greater than 0.5. Thus, the composite reliability of the constructs was ensured (Hair, 2009). At last, the discriminant validity of the constructs was evaluated. In accordance with tables 2 and 3, AVE was greater than the MSV and ASV. Moreover, the square root of each AVE was found to be higher than the bivariate correlation among the factors. These results inform of the presence of discriminant validity of the constructs (Hair, 2009).

III.VI. INVARIANCE OF MEASURES

For further validation of the new scale, a muti-group CFA was performed to evaluate whether the items were invariant across groups (Beqiri et al., 2009; Coulacoglou & Saklofske, 2017; Fernández-Cavia et al., 2014; Hair, 2009). The sample was split in two groups i.e., currently enrolled (288) and graduated students (192). For the assessment of invariance an unconstrained 9-factor measurement model was estimated. The model fitness indices were $\chi 2$ /df = 1.516; GFI = 0.913; CFI = 0.952; TLI = 0.968; RMSEA = 0.025. These indices ensured that the sub-groups had similar number of latent constructs and their associated measurement items remained similar as well. Additionally, a complete metric invariance was performed ($\Delta\chi 2$ (55) = 44.757, $p > .05$), suggesting that the loadings were consistent among both groups. Thus, it was confirmed that the scale was valid and fit.

IV. DISCUSSION

This research developed a valid and reliable scale for measuring service quality in online higher education in context of Pakistan. The literature review revealed that service quality played a significant role in quality of higher education, and it is emerged as a critical success factor for implementation of higher education model. Literature review also highlighted the issue that no universal set of dimensions have been identified to measure the service quality across the industries, so before measuring service quality, instrument must fit to the context. The research concluded and verified the findings of literature review that being a social construct "service quality" scale cannot be same in all contexts. The research findings endorsed the conclusion as service quality scale developed in this study has nine dimensions and 55 items which are entirely different from the service quality models developed for other industries even the current study concludes that lot of difference exists in service quality scale in higher education and in online higher education. There were some limitations in the study. The elements included in the study refer primarily to the course content and support of the online courses and do not include factors corresponding to the design and development of a good quality online course. Also, the data in the present study was self-reported and social desirability may have been a factor in the responses of the participants. Additionally, the scale was tested with a small sample i.e., 480 respondents and needs to be tested in larger samples. Also, the service quality may differ among different universities and subjects. For instance, the current scale doesn't accommodate for any measures required for evaluation of students taking courses from natural sciences. Nonetheless, educationists can use this scale to highlight the areas where improvement is required to increase the overall effectiveness of higher education model. It can also serve as a guideline for policy makers while allocating resources to various dimensions of service quality. The scale developed in the present study represents some of the key characteristics of the online applications and systems being used for online education. For academicians and researchers, the study significantly contributes to the service quality scale development literature in the field of higher education. Further, studies can also be conducted to measure the service quality in other study disciplines.

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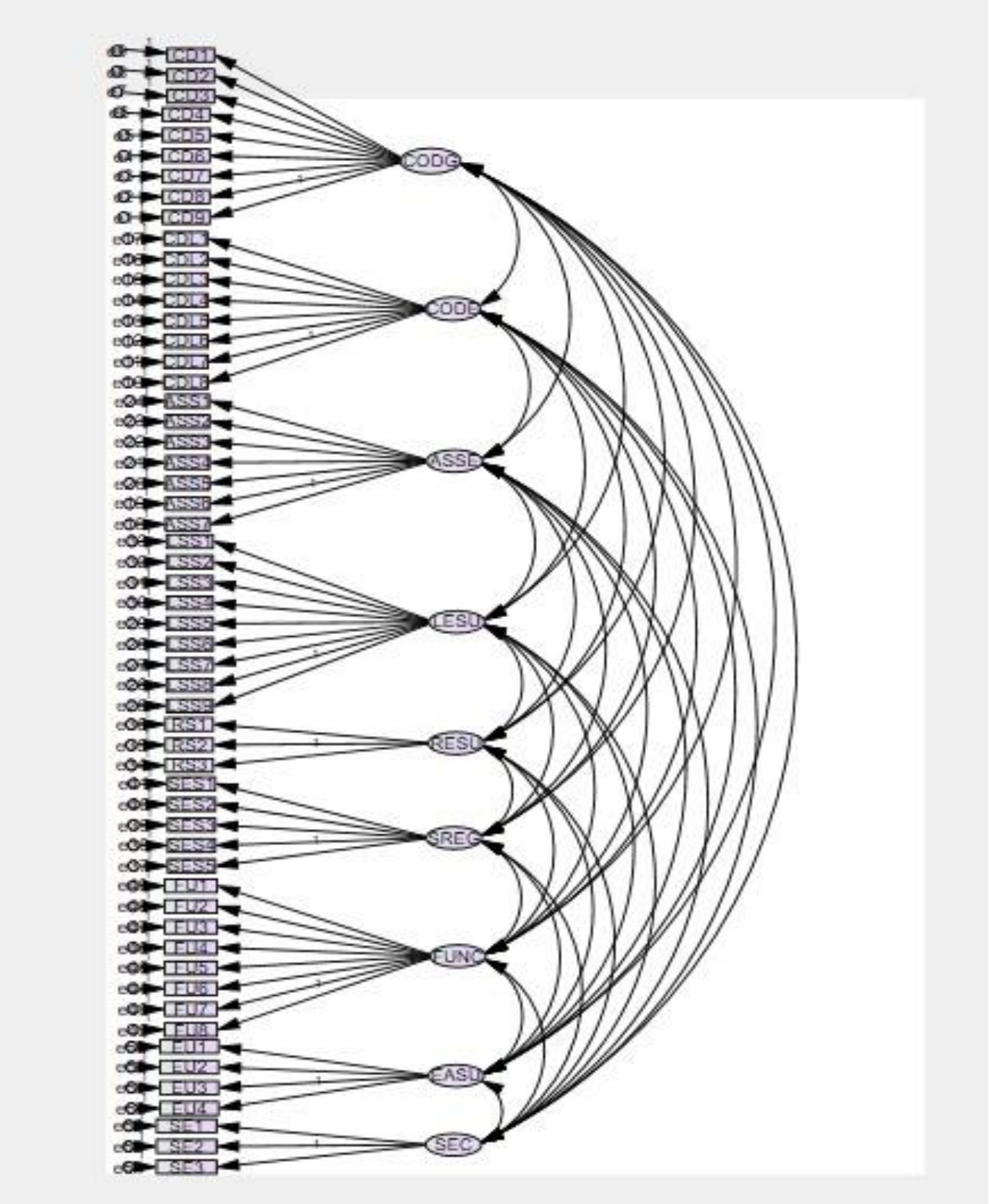

Figure-2 Model of Service Quality in Higher Education after applying CFA

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