An approach to evaluate service quality in polytechnic education institutes: a case study

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Abstract: The aims of the study are to identify and evaluate the quality of service perceived by students and teachers. Hypothesis have been formulated and tested to examine for service quality gaps in of polytechnic education institutes (PEIs) of Madhya Pradesh, India. A Kano methodology has been used to prioritise service quality factors. The SERVQUAL method has been used to identify the gap between service rendered and service as perceived by students and teachers. The hypothesis has been evaluated using statistical tools. It has been reported that there is significant difference between rendered service quality and expectations of students. There is a need of improvement in service quality factors such as academic excellence, library, infrastructure, career counselling, etc. Further, curriculum structure, physical entities, assessment, feedback and reward need to be improved to encourage more enrolment. The study may help polytechnic education planners, policymakers, practitioners, managers and administrators to improve the service quality in PEIs. The proposed study incorporates the expectations of students and teachers for improvement in service quality in PEIs.

Keywords: polytechnic education institutes; PEIs; service quality factors; Kano model; SERVQUAL; hypothesis testing.

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1   Introduction

The aim of polytechnic education institutes (PEIs) is to provide their students with quality education that enables them to be competent for their future employment. The PEIs are playing a vital role in human resource development by providing skilled manpower, improving quality of life, and enhancing productivity of manufacturing organisations (Kinker et al., 2020). There has been an exponential increase in the number of PEIs in India during last decade. A decline in the intake of students in PEIs of India has been observed during last decade (AICTE, 2019) (Figure 1). Therefore, PEIs are striving hard to maintain their infrastructure, financial and human resources. This has resulted in weaknesses in desired competencies to attain in pass outs of these institutions (La Fata and Lupo, 2017). It is leading to the unemployment of diploma engineers and has created to a barrier to new enrolment in PEIs. The expectations of government and stakeholders towards improvement has guided to improve quality of service in PEIs (La Fata and Lupo, 2017; Kardoyo et al., 2020). Thus, the challenge is to meet the stakeholder's needs through attaining the right balance between perception and expectation (Sahney, 2011a, 2011b; Atakora and Yeboah, 2012). Service quality factors help to capture the actual needs of stakeholders (Sahney, 2011a; Galeeva, 2016; Raissi, 2018). The current situation has forced the institutions to improve their service quality in order to survive in the current competitive market. The quality of service of any educational institution can be enhanced by not only taking into account students need in perspective but also by making the point of view of teachers indispensable. In the recent literature, the authors have developed different models, frameworks and approaches for enhancement of service quality (Sahney, 2011a, 2011b; Cheng and Tam, 1997; Abari et al., 2011; Galeeva, 2016; Weerasinghe and Fernando, 2017). The successful improvement in quality of service may enhance the student enrolment in institutes and

attract employers towards placement of students (Abari et al., 2011; Sahney, 2011a; Wagner et al., 2017).

Figure 1   Enrolment and intake of PEIs in India (see online version for colours)
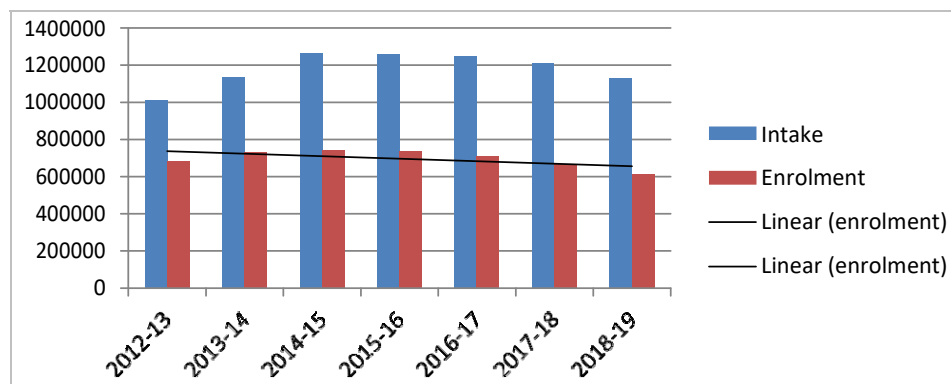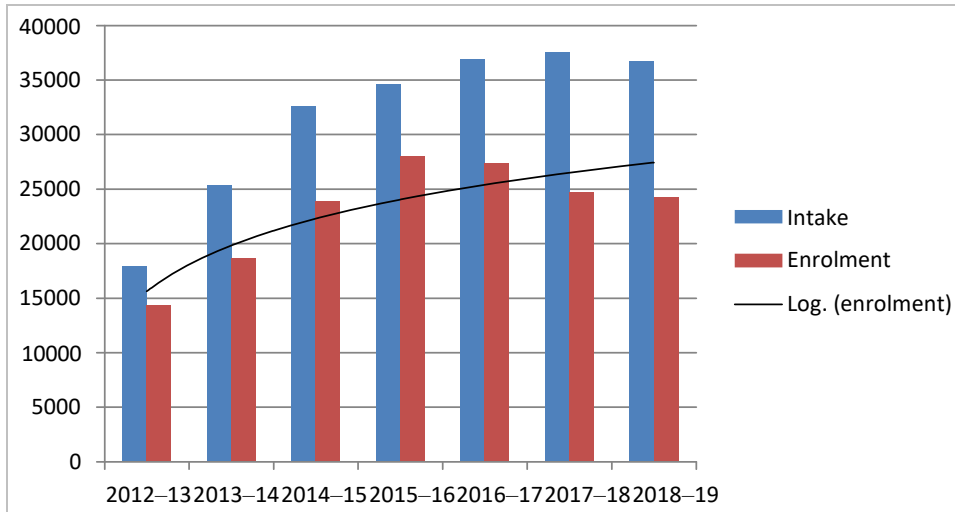

Source: AICTE (2018–2019)

In order to ensure that PEIs maintain their appeal to students as a viable career choice and to teachers as a good career, it is necessary to focus on the quality of services. Identification of the service quality variables helps to develop a framework for improving the quality of services. The present study has addressed with the problems encountered in current scenario of Indian PEIs and has proposed a framework that would help to address these issues.

1.1   Need for the study

PEIs in India have reported a declining trend in enrolment over the past three years and a similar trend is reported for PEI's in Madhya Pradesh state (Figure 2). This can be attributed due to lack of job placement opportunities for the engineering diploma holders. Many reasons have contributed to this decline such as lack of facilities, old curriculum, stereo strategic plans, etc. It has led to deficiencies is degree of the service required competence in terms of knowledge and skills. An improvement in the quality of the service is the key to overcoming these problems. This, in turn, will help to reverse the declining of enrolment trend. The quality of service in students and teachers needs to be improved which is why there is a need of identification of various factors that affect the quality of service both from the perspective of student's and teacher's in PEIs. Sahney (2011a) and Galeeva (2016) stated that the quality of service of any educational institute can be enhanced not only by taking into account the students' needs but also focus on teacher's indispensable.

Many studies have reported the identification of service quality factors towards quality improvement in PEIs (Fernandes et al., 2014; Kinker et al., 2019a, 2019b; Romera et al., 2020). This identification itself does not help to improve the service quality therefore there is a need to evaluate the gap between the actual perception and expectations of stakeholders that provides a structured solution approach to improve service quality of PEIs. The present study fulfils these gaps and attempts to provide an answer through a real-life case study.

Figure 2   Enrolment and intake of PEIs in Madhya Pradesh (see online version for colours)

Source: AICTE (2018–2019)

1.2   Objectives of the study

To improve the quality of service in PEIs, it is necessary to identify factors that influence the quality of services for both students and teachers perspective is needed to improve the service quality of PEIs. The objectives of the study are as follows:

RO1   Identify and select factors that have an impact on the quality of services offered to students and teachers.

RO2   Prioritise the selected service quality factors in different 'Kano' categories.

RO3   Investigate the perception and expectation of stakeholders using Kano 'must be' category factors.

RO4   Analyse the gap between the perception and expectations of stakeholders.

RO5   To find out whether there is a need for improvement in the quality of services.

RO6   To provide a structured solution approach to improve the quality of service in PEIs.

1.3   Organisation of the paper

The paper is organised as follows: a review of literature has been presented in Section 2. In Section 3, the research methodology has been outlined. A case study has presented in Section 4. The results of the study have shown and discussed in Section 5. Section 6 has concluded the current work and scope of future work has been provided.

2   Literature review

The globalisation of technical education has contributed in a need to improve the quality of PEIs service. The growing importance of quality assurance and management in the technical education sector has led to the use of different quality improvement methodologies. Many researchers have used quality perception and its tools to improve quality (Franceschini and Terzago, 1998; Matzler and Hinterhuber, 1998; Franceschini and Rafele, 2000; Tan and Pawitra, 2001; Sahney et al., 2004; Yang, 2003; Tontini, 2007; Baki et al., 2009). Many studies have covered the engineering and management institutions with focus on service quality but literature on PEIs in India is scanty.

Table 1   Identified service quality improvement factors

S. no.	Factor		Sub-factor	Source
1	Academic excellence	C1	Teaching-learning process	Khan and Mahapatra (2008), Khanna (2012), Bozbura et al. (2011), Kinker et al. (2019a)
		C2	Excellent results	
		C3	Teachers' expertise	
		C4	Academic performance cell	
		C5	Performance improvement	
2	Alumni	C6	Alumni chapters	Mehta et al. (2014), Natarajan (2000), Sayeda et al. (2010), Sudha (2013), Venkataram and Giridharan (2007), Fernandes et al. (2014)
		C7	Alumni contributions	
		C8	Alumni guidance	
		C9	Alumni events	
3	Audit	C10	Execution of audit	Rugarcia et al. (2000), Sarin (2000), Magrupov et al. (2015), Prados et al. (2005), Tannock (1991)
		C11	Reliability of audit	
4	Curriculum structure	C12	Adequacy of curriculum	Lagrosen et al. (2004), Khanna (2012), Jain et al. (2013), Tulsi and Poonia (2015), Sreenivas and Babu (2015), Wilcox and Wilcox (2010)
		C13	Elective courses	
5	Evaluation and reward	C14	Reward and appreciation	Michael et al. (1997), Bozbura et al. (2011), Kinker et al. (2019b), Romera et al. (2020)
		C15	Evaluation system	
6	Extra curricular activities	C16	Personality development	Sahu et al. (2008), Gulbarga et al. (2012)
		C17	Publication	
		C18	Youth organisations	
7	Faculty	C19	Training programs	Keelson (2011), Khanna (2012), Sahney (2012), Atakora and Yeboah (2012), Chauhan and Sharma (2015), Dandage and Khandekar (2015), Kulkarni et al. (2015)
		C20	Managerial decision	
		C21	Teaching skills	
		C22	Expert lecture	
8	Industry institute linkage	C23	Industrial visits	Sahney (2012), Atakora and Yeboah (2012), Jain et al. (2013), Sreenivas and Babu (2015)
		C24	Work experience	
		C25	MoU	

Table 1 Identified service quality improvement factors (continued)

S. no.	Factor		Sub-factor	Source
9	Infrastructure	C26	Appropriate facilities	Sahu et al. (2008, 2013), Camgoz-Akdag and Zaim (2012), Gambhir et al. (2012), Khanna (2012), Chowdhury et al. (2013), Silva and Fernandes (2011), Sreenivas and Babu (2015)
		C27	Smart classrooms	
		C28	Accommodation	
10	Internal revenue generation	C29	Regular resources	Experts opinion
		C30	Online examination	
		C31	Fabrication/maintenance work	
11	Library	C32	Learning materials	Soni et al. (2014), Clewes (2003), Sarin (2000), Lagrosen et al. (2004), Noaman et al. (2017), Gambhir et al. (2016)
		C33	Working hours	
12	Physical amenities	C34	Power facility	Khan and Mahapatra (2008)
		C35	Computer facility	
		C36	Adequate area	
13	Placement and career counselling	C37	Counselling cell	Gambhir et al. (2012), Khanna (2012), Sahu et al. (2013), Pandi et al. (2009, 2012), Pandi and Sethupathi (2013)
		C38	Entrepreneurship	
		C39	Higher education	
		C40	Mock test	
14	Society	C41	Incubation centres	Sahu et al. (2008), Khanna (2012), Chowdhury et al. (2013), Lagrosen et al. (2004), Pandi et al. (2012), Silva and Fernandes (2011)
		C42	Training facilities	
		C43	Remote centres	
15	Green campus initiatives	C44	Renewable energy	Experts opinion
		C45	Sump facility	
		C46	E-waste disposal	
		C47	Landscaping	
16	Feedback mechanism	C48	Performance measurement	Ahuja (2011)
		C49	Feedback from industry	
		C50	Feedback from alumni	
17	Standard operating procedure (SOP) on documents	C51	Declaration of results	Experts opinion
		C52	Award of certificates	
		C53	Clearances from institute maintain a quality system	
18	Financial autonomy	C54	Financial matter financial need	Expert opinion

2.1 Service quality improvement factors

Quality has become a critical aspect in today's fiercely competitive environment. There are a number of key factors that need to be addressed in order improve and manage PEIs.

Table 1 summarises the service quality improvement factors observed in various related literature to maintain the quality of academic services. As a result, many higher education institutions are beginning to understand this and are contending for students, both in the national and international markets (Paswan and Ganesh, 2009). The technical education is a part of service sector, and therefore considers education as a service to facilitate generalisation of service quality factors for this sector. More careful generalisation is needed with regard to its complex characteristics of technical education (Owlia and Aspinwall, 1996; Lentner, 2007).

2.2   *Service quality improvement methodologies (SERVQUAL)*

Through time, technical education has gradually recognised as a service industry. The institution must try to identify and prioritise the needs of their stockholders. Parsuraman et al. (1988) have developed SERVQUAL as a method for evaluating customer perception of service quality in service organisations. Subsequently, SERVQUAL has been used by many researchers to assess the quality of services in verity of sectors like transportation, hospitals, education, etc. Jain (1997) has critically analysed the problems associated with the implementation of multipoint entry and credit systems in PEI's of Madhya Pradesh. In its study, Jain (1998a) has proposed an approach to rural development through community polytechnic scheme by promoting and organising the service quality in PEIs. The need for service quality improvement has been emphasised in his work. Jain (1998b) has studied the importance of the industry-institute relationship and has concluded that effective relation between industry and institute is mandatory for the survival of both the entities. He has suggested that quality is the key to achieving it. Jain (1999) has stated that the development of information technology is needed to improve the quality and effectiveness of the technical education. Abdullah (2006) has conducted a study to test and compare the relative effectiveness of different tools in higher education to determine out capabilities of instruments in terms of measuring reliability, validity and dimensionality. Sayeda et al. (2010) have explored the quality management practices employed in engineering educational institutions from a management perspective in India. Sahney (2011a) has conducted an empirical study on students at management institutes in India to identify customer requirements. The study helped in evaluating service quality with the help of SERVQUAL and gap analysis. Atakora and Yeboah (2012) have examined the quality of polytechnic education in Ghana by focusing on the role of stakeholders. Jain et al. (2013) have developed a multidimensional scale to measure the service quality in the context of higher education in India. An exploratory factor analysis (EFA) approach has been used to identify the latent structure of seven dimensions viz., input quality, curriculum, academic facilities, industry interaction, interaction quality, support facilities and non-academic processes. Iro-Idoro et al. (2014) have measured the student's perception of service quality in Nigerian polytechnic institutes by applying SERVQUAL scale. Ashraf et al. (2016) have identified quality education, faculty credential, financial aids, career prospects, administrative services, general facilities, education costs, library services, curricula structure, that have an impact on the quality of education of private universities in Bangladesh. Alhalwaki and Hamdan (2019) have conducted a study to identify the factors that influence the higher education strategies in Bahrain. The gap has been identified in the study between strategy and implementation practices in higher education. Kinker et al. (2019a) have prioritised the service quality factors for polytechnic

institution on the basis on student's perception of PEIs of India. Service quality barriers have been identified, selected and modelled for PEIs by Kinker et al. (2019b) to develop a structured hierarchical model using the MICMAC analysis. The developed model would help decision-makers, practitioners, managers and policy makers polytechnic education to anticipate critical barriers to service quality improvement in PEIs.

2.3 Kano approach

Kano et al. (1984) have introduced a theory of attractive quality to better explain how different quality attributes play different roles for customers. One of the key features of the theory of attractive quality is that it provides a methodology for categorising and understanding the effects of different quality attributes. Kano methodology is a link between the theory of attractive quality and a method used to bring theory into practice. Kano methodology has been used in integration with techniques such as SERVQUAL, QFD, TQM, etc. for factor identification and categorisation for many researchers. Tontini (2007) has presented a method that integrated the Kano and QFD methodology to identify key considerations in the product development process. Chaudha et al. (2011) have conducted a study based on the Kano model and QFD analysis to use the proposed function to adjust the improvement ratio of a service attribute in order to recognise its importance. Wu and Wang (2012) have used fuzzy Kano model for the classification and assessment of customer requirements. Tsai and Yeh (2016) have used strategic experimental module (SEM) with the Kano model to identify attributes that are further grouped into five elements of experience marketing framework (EFM). Ullah and Tamaki (2011) have proposed a methodology for assessing customer response in order to identify the current status of all product attributes using the Kano model.

2.4 Research gap

Several studies have proposed the possible use of perception of quality and quality tool for service quality improvement. These studies have helped to develop a framework for the identification of critical factors from the point of view of stakeholders. A majority of studies have addressed engineering education, management, vocational higher education for prioritisation of service quality improvement factors. Other related literature focuses on other areas including assembly line balancing, amusement park, product development and academic website (Chaudha et al., 2011; Lee and Huang, 2009; Avikal et al., 2014; Ullah and Tamaki, 2011) has also been reviewed. After careful review of literature, it has been summarised that service quality literature on PEIs of India is scanty. Therefore, it necessitates the need for the present work.

3 Methodology

In this study, the methodology is divided into two parts; the first part is deals with identification, selection, and prioritisation of quality improvement factors for both students and teachers. Prioritisation of the service quality factors is shall be carried out on the basis of priority of service recipients by using the Kano model. The second part

includes gap analysis and hypothesis testing. The detailed research methodology is as shown in Figure 3.

Figure 3   Research methodology (see online version for colours)
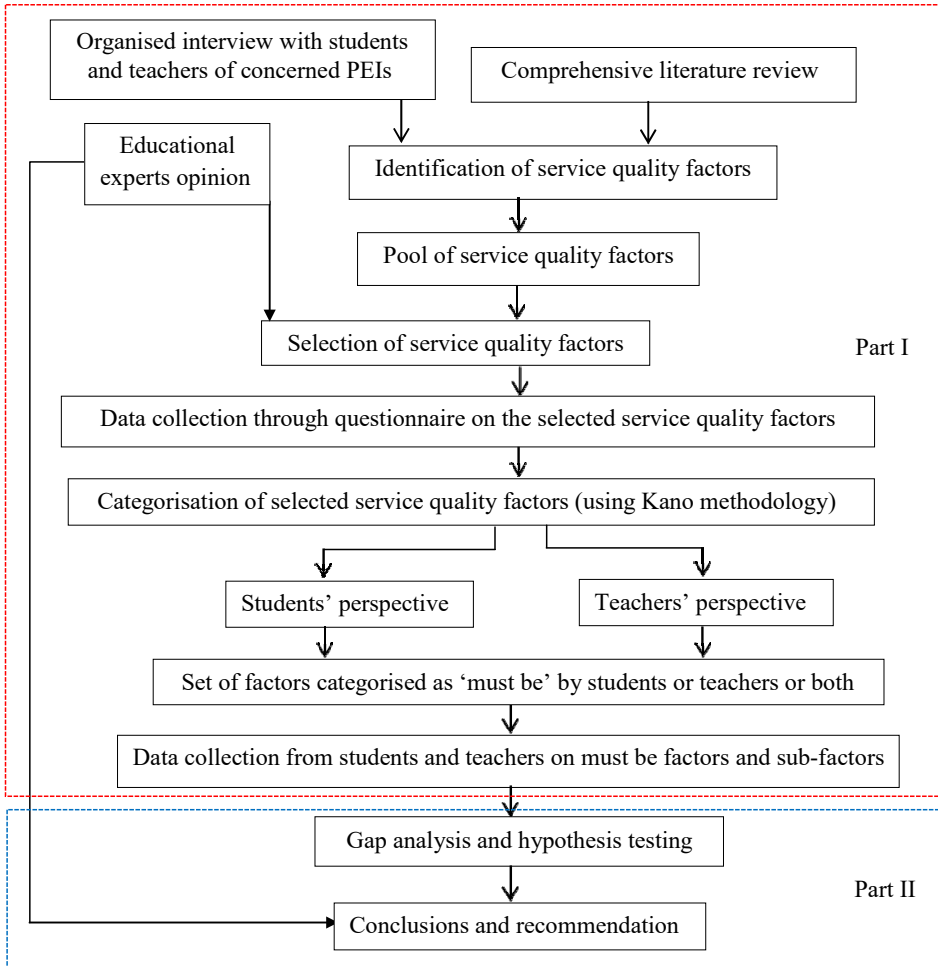
3.1   Kano model

Kano et al. (1984) have proposed a model that prioritises the service quality factors based on the customer needs in six categories of attributes. These attributes are described as follows:

- Must be attributes – These attributes are considered necessary by the customer, it do not improve the satisfaction level of the customer but their absence leads to an increased level of dissatisfaction.

- Attractive attributes – The presence of these attributes results in improved satisfaction level of customer. Their absence has no effect on customer satisfaction but affects the functionality adversely.

- One-dimensional attributes – These attributes affect both functionality and customer satisfaction, their presence leads to improved functionality and customer satisfaction level.

- In-different attributes – Customer satisfaction level is not affected by these attributes but they do affect the functionality.

- Reverse attributes – The customer satisfaction level improves with the absence of these attributes.

- Questionable attributes – The attributes that result in a contradiction in customer responses.

Kano has stated that dissimilar types of customer prospects have a dissimilar effect on customer satisfaction. For some attributes, customer satisfaction is only slightly enhanced even the product/service performance is significantly improved. Kano et al. (1984) have emphasised that must be attributes contribute to increased level of dissatisfaction and it is not enough to provide basic performance needs and just satisfy customers. Therefore, 'must be' attributes should be focused upon to sustain present competitive environment. The details of Kano model has been depicted in Figure 4. A Kano questionnaire needs to develop to prioritise the data related to the relative importance of factors from the perspective of stakeholders. The present study have considered a traditional questionnaire survey approach, a sample is shown in Figure 5.
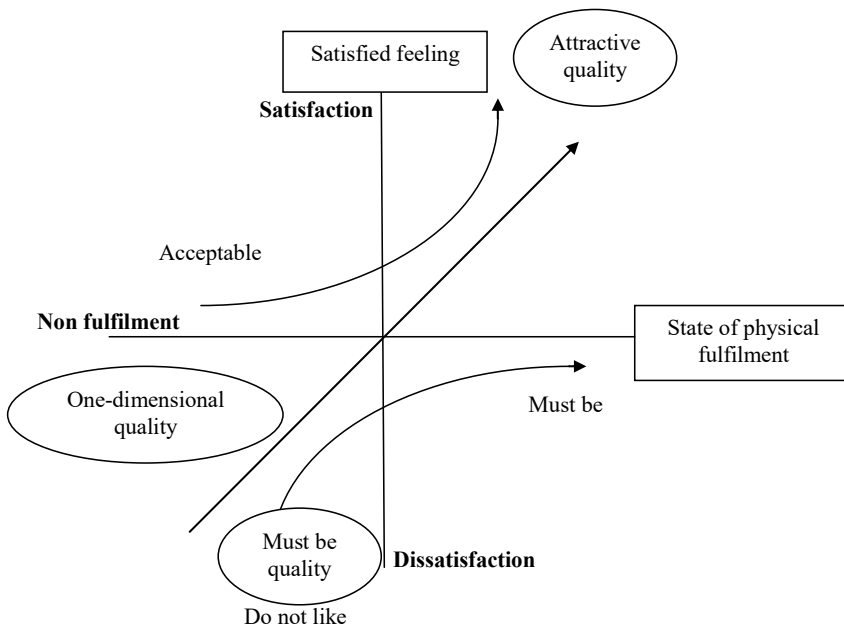
Figure 4   The Kano's model

Figure 5   Sample response of traditional Kano questionnaire

3.2   SERVQUAL

Parsuraman et al. (1988) have developed SERVQUAL to measure the customer perception of service quality in service organisations. The gap scores have been evaluated on the basis of the difference between expectation and perception. This provides insight into the customer satisfaction and dissatisfaction with the quality of services offered. In present work, a questionnaire has been developed to capture perception and expectation scores for the common 'must be' factors for teachers and students obtained using Kano model. These gap scores have been analysed using statistical analysis tools to gain more insight into the perception and expectations of students and teachers.

3.3   Hypothesis testing

Hypothesis testing is used to infer the results of a hypothesis based on trial data from a larger population. This test confirms whether or not the main hypothesis is true. A research hypothesis has been tested by measuring and investigating a random sample of the population.

4   Case study

4.1   Scope of study

To improve service quality in PEIs, a study has been conducted in six PEIs located in Madhya Pradesh, India. PEIs enable students to become employable without spending many years behind in numerous courses. Different courses are available in PEIs that covering many fields when it comes to education in India. The main aim of polytechnics in India is to make students employable. In the past few years, the sudden decline has been observed in the employment of polytechnic diploma holders in India that have a major impact on the enrolment of PEIs. Such problems arise due to a lack of required knowledge and skills in pass-outs based on industry expectations. To find a solution to this problem, attention must be given to essential service quality factors that will help to improve the quality of service in Indian PEIs. The findings of the present study may also help practitioners, decision-makers, and researchers to initiate the same study in other institutions that facing such problems by investigating the new set of factors.

4.2 Identification, selection, and prioritisation of quality improvement factors

4.2.1 Identification and selection of service quality factors

Service quality factors have been identified using a comprehensive literature review, visits to the concerned six PEIs of the case study, and personal interviews with educational experts. Interviews have been organised with the students and teachers of the concerned PEIs. The PEIs have been selected based on their location and accessibility to carry out the case study. The present study has included only final year students from all selected institutes and teachers for interview purposes. After that, group interviews were performed in each PEI. Responses have been collected from students and teachers. The collected responses in qualitative form, has been used for analysis using open coding. Strauss and Corbin (1998) have stated that 'open coding' is an analytical process that helps to identify properties in the dataset and their dimensions. The final structured responses merged with the result of detailed literature reviews and resulted in a comprehensive set of 54 service quality factors.

Further, these factors were clustered into 18 prioritise using experts' opinions for a better understanding of areas that needed improvement. These 18 quality improvement factors are used to perform the further study. The group of 25 experts has been selected from the concerned institutes, all experts awarded with PhD, and having more than 23 years of experience in the concerned field. The finally selected service quality factors for further study are shown in Table 1.

4.2.2 Prioritisation of service quality factors

To assess the relative importance of selected service quality factors, Kano approach has been utilised in this study. In this context, a separate questionnaire has been developed using experts' opinions and distributed to 195 students and 135 teachers of case PEIs. The sample questionnaire can be provided by the corresponding author based on request. The respondents has been asked to provide their opinion in on scale 1 to 5 (i.e., '1 = I like in that way, 2 = it must be in that way, 3 = I am neutral, 4 = I can live with it, 5 = I dislike it') (Kano, 1984). A total of 128 valid responses have been received from students and 87 valid responses have been received from teachers. The responses from varying as to the different Kano categories under these service quality factors would be classified; to remove the anomaly and ease of analysis frequency distribution has been performed (Kano, 1984; Matzler and Hinterhuber, 1998). Based on the Kano evaluation matrix and frequency distribution analysis, the service quality factors have been classified into six different Kano categories ('A = attractive, M = must be, O = one-dimensional, I = indifferent, R = reverse, Q = questionable) (Matzler and Hinterhuber, 1998; Sahney, 2011a, 2011b). The analysis outcomes are separately presented in Tables 2 and 3 for students and teachers.

It is noteworthy that four service quality factors have classified under the 'attractive (A)' category, five under 'must be (M)' category, four under 'one-dimensional (O)', five under 'indifferent (I)', and none of the factor classified under 'reverse (R) and questionable (Q)' category in students perspectives. Similarly, Table 3 represents, four service quality factors have classified under the 'attractive (A)' category, six under 'must be (M)' category, five under 'one-dimensional (O)', and three-factor classified under 'indifferent (I)' category based on teachers perspectives.

Table 2   Prioritisation of factors using Kano methodology (students' perspective)

Sn	Service quality factors	Percentage of replies								Customer satisfaction	
		A	O	M	I	R	Q	Total	Category	Extent of satisfaction	Extent of dissatisfaction
1	Library	9.53	29.56	43.38	16.28	0	1.25	100	M	0.3909	0.7294
2	Infrastructure	8.48	9.25	45.84	36.43	0	0	100	M	0.1773	0.5509
3	Extracurricular activities	20.63	29.78	28.39	21.20	0	0	100	O	0.5041	0.5817
4	Audit	22.64	16.45	25.64	35.27	0	0	100	I	0.3909	0.4209
5	Internal revenue generation	11.45	4.65	16.47	43.58	19.80	4.05	100	I	0.1610	0.2112
6	Feedback mechanisms	34.68	17.36	17.68	30.28	0	0	100	A	0.5204	0.3504
7	Placement and career counselling	9.63	27.46	44.63	18.28	0	0	100	M	0.3709	0.7209
8	Faculty	7.52	21.91	55.65	14.92	0	0	100	M	0.2943	0.7756
9	Financial autonomy	13.73	9.21	35.78	41.28	0	0	100	I	0.2294	0.4499
10	Alumni	27.0	38.0	22.14	12.32	0.54	0	100	O	0.6500	0.6014
11	Society	29.75	15.24	21.57	30.77	2.67	0	100	I	0.4499	0.3681
12	Curriculum structure	32.53	20.56	21.53	25.38	0	0	100	A	0.5309	0.4209
13	Standard operating procedure (SOP)	17.60	45.40	25.60	11.40	0	0	100	O	0.6300	0.7100
14	Academic excellence	7.57	24.52	50.57	17.34	0	0	100	M	0.3209	0.7509
15	Evaluation and reward	33.79	21.89	16.71	25.32	0.45	1.84	100	A	0.5568	0.3860
16	Green campus initiatives	10.16	10.98	35.11	43.75	0	0	100	I	0.2114	0.4609
17	Industry institute linkage	22.60	41.89	22.76	12.75	0	0	100	O	0.6449	0.6465
18	Physical amenities	34.46	23.63	18.46	23.45	0	0	100	A	0.5809	0.4209

Table 3 Prioritisation of factors using Kano methodology (teacher's perspective)

Sn	Service quality factors	Percentage of replies								Customer satisfaction	
		A	O	M	I	R	Q	Total	Category	Extent of satisfaction	Extent of dissatisfaction
1	Library	11.60	20.44	43.65	22.67	0	1.64	100	M	0.3257	0.6515
2	Infrastructure	6.20	13.80	60.20	19.80	0	0	100	M	0.2000	0.7400
3	Extracurricular activities	35.61	21.21	18.57	24.36	0	0.25	100	A	0.5696	0.3987
4	Audit	32.23	36.24	15.67	15.86	0	0	100	O	0.6847	0.5191
5	Internal revenue generation	25.42	12.87	18.22	43.49	0	0	100	A	0.3829	0.3109
6	Feedback mechanisms	11.38	9.71	32.38	46.53	0	0	100	I	0.2109	0.4209
7	Placement and career counselling	18.25	34.57	30.58	16.60	0	0	100	O	0.5282	0.6515
8	Faculty	41.16	23.15	11.37	24.32	0	0	100	A	0.6431	0.3452
9	Financial autonomy	11.44	26.65	44.54	17.37	0	0	100	M	0.3809	0.7119
10	Alumni	20.24	14.87	21.23	36.34	5.43	1.89	100	I	0.3788	0.3895
11	Society	30.70	37.30	17.40	14.60	0	0	100	O	0.6800	0.5470
12	Curriculum structure	4.25	17.84	64.25	11.37	1.30	0.99	100	M	0.2260	0.8401
13	Standard operating procedure (SOP) on documents	51.41	12.68	8.41	26.30	1.20	0	100	A	0.6486	0.2134
14	Academic excellence	9.73	19.36	49.87	20.44	0	0.60	100	M	0.2926	0.6964
15	Evaluation and reward	5.21	10.21	57.27	25.91	1.40	0	100	M	0.1563	0.6843
16	Green campus initiatives	26.48	19.61	22.48	31.43	0	0	100	I	0.4609	0.4209
17	Industry institute linkage	16.65	33.52	28.76	14.60	6.47	0	100	O	0.5364	0.6658
18	Physical amenities	16.30	36.80	33.20	13.70	0	0	100	O	0.5310	0.7000

The present study considered only 'must be' (only most essential) category factors for analysing the gap between perception and expectations of students and teachers both. The objective of the study is to improve the quality of service of PEIs through focusing the actual need of students and teachers, therefore authors have combined the 'must be' category factors for better understanding the improvement areas in both the stakeholder's perspectives. The combination provided eight essential service quality factors that are most important to both students and teachers, these factors have been used for further analysis.

4.3   Gap analysis and hypothesis testing

To identify the gap between perception and expectations of students and teachers, the SERVQUAL approach has been utilised. The application of SERVQUAL helps in evaluating the gap between stakeholders' perceptions and expectations. Several statistical tools have been applied to gain more insights. The following steps have been performed to evaluate the gap between students and teachers perception and expectations of case institutions.

4.3.1   Formulation of research questions and hypothesis development

The following research questions have been formulated to assess the need for study:

RQ1   Is there a need to improve the quality of services offered to students and/or teachers for the service quality factors they considered important?

RQ2   Is there a difference in the quality of services offered to students and teachers?

RQ3   Is there a difference in the quality of services offered to the students of private and government PEIs?

RQ4   Is there a difference in the quality of services offered to the private and government PEIs teachers?

To answer the above-asked research questions, the following hypotheses have been formulated:

H1   There is no significant difference between students' perception and their expectations of critical service quality factors.

H2   There is no significant difference between teachers' perception and their expectations of critical service quality factors.

H3   There is no significant difference in the viewpoint of students and teachers regarding the quality of services offered to them by PEIs.

H4   There is no significant difference in the viewpoint of students of government and private funded PEIs regarding the quality of services offered to them by PEIs.

H5   There is no significant difference in the viewpoint of teachers of government and private funded PEIs regarding the quality of services offered to them by PEIs.

4.3.2 Population and sample selection to conduct the study

The population for this study is similar to previous stages (i.e., students and teachers of six case PEIs). To conduct this study, a questionnaire has been developed using 'must be' service quality factors and distributed among 155 students and 91 teachers. These samples have been collected through stratified sampling.

4.3.3 Data collection

Responses from the students and teachers have been collected using a five-point Likert scale, separate questionnaires for students and teachers have been floated in concerned PEIs. A total of 128 valid responses were received from students and 87 from teachers.

4.3.4 Data analysis

The collected responses from students and teachers have been analysed by following different steps.

4.3.4.1 Application of SERVQUAL and reliability analysis

The collected responses from students and teachers have been separately analysed using the SERVQUAL method. Further, reliability analysis has been performed to check the scale reliability. A five-point Likert scale has been used to collect the responses. The scale reliability is mainly checked using Cronbach's alpha value to measure how closely related to a set of items into a group (Sahney, 2011a). The Cronbach alpha value of 0.7 and above is acceptable for service quality research (Nakip, 2006). The analysis observed that the alpha values for perception and expectations of both students and teachers were within acceptable limits and shown in Table 4.

Table 4 Reliability coefficients of students and teachers based on different criteria

Factors	Students Cronbach alpha		Teachers Cronbach alpha	
	Expectation	Perception	Expectation	Perception
Academic excellence	0.7289	0.7391	0.7012	0.8645
Curriculum structure	0.8181	0.8592	0.8129	0.8948
Evaluation and reward	0.7487	0.7987	0.7367	0.8624
Financial autonomy	0.7852	0.7272	0.7891	0.8671
Faculty	0.7025	0.7434	0.7132	0.8631
Infrastructure	0.7149	0.7217	0.7612	0.8583
Library	0.8010	0.7341	0.8367	0.8635
Placement and career counselling	0.7852	0.7272	0.7891	0.8671

Table 5   Means of students and teachers based on different criteria

Students

		Gender			Location			Institute		
		Female (N = 48)	*Male (N = 80)*	*Total (N = 128)*	*Rural (N = 63)*	*Urban (N = 65)*	*Total (N = 128)*	*Private (N = 36)*	*Government (N = 92)*	*Total (N = 128)*
	E	3.622283	3.588043	3.600883	3.62	3.57	3.60	3.609903	3.597353	3.600883
	P	2.995471	3.09837	3.049592	3.0973	3.003	3.0495	3.641304	2.818053	3.049592
	G	−0.62681	−0.48967	−0.55129	−0.5272	−0.5745	−0.5512	0.031401	−0.7793	−0.55129

Teachers

		Gender			Educational qualification			Institute		
		Female (N = 33)	*Male (N = 54)*	*Total (N = 87)*	*UG (N = 10)*	*PG (N = 31)*	*PhD (N = 46)*	*Private (N = 21)*	*Government (N = 66)*	*Total (N = 87)*
	E	3.99473	3.936393	3.958521	4.03913	3.97891	3.92722	4.124224	3.905797	−3.958521
	P	2.934124	2.947665	2.942529	2.8	3.0056	2.9310	3.757764	2.683136	−2.942529
	G	−1.06061	−0.98873	−1.01599	−1.2391	−0.9733	−0.9962	0.36646	1.22266	−1.01599

Note: E = expectation, P = perception and G = gap.

Table 6 T-test for comparison of the mean

Sn	Factors	For students' expectations and perception N = 128				For teachers' expectations and perception N = 87				For gap between students and teachers' expectations and perception			
		Mean	Standard deviation	F value	P value	Mean	Standard deviation	F value	P value	Mean	Standard deviation	F value	P value
1	Academic excellence	3.7844	0.230862	206.85	0.000	4.0621	0.328931	218.02	0.000	-0.7813	0.657093	12.66	0.000
		3.0031	0.569561			2.9609	0.612915			-1.1011	0.631627		
2	Curriculum structure	2.6875	0.687343	100.19	0.000	4.2011	0.369316	528.07	0.000	0.6563	0.717470	546.49	0.000
		3.3438	0.278847			2.1609	0.741205			-1.5690	0.634165		
3	Evaluation and reward	3.0781	0.616178	39.14	0.000	3.9598	0.529471	59.77	0.000	0.4141	0.670261	145.53	0.000
		3.4922	0.425489			3.2586	0.659731			-0.7011	0.657956		
4	Financial autonomy	2.2190	1.149720	67.70	0.000	3.8391	0.805123	152.82	0.000	0.9141	1.226200	236.22	0.000
		3.1328	0.507750			2.3678	0.764244			-1.471	1.108520		
5	Faculty	3.5313	0.377778	103.46	0.000	3.6351	0.359272	35.36	0.000	-0.6094	0.739593	1.31	0.253
		2.9219	0.562746			3.1408	0.686986			-0.4943	0.697772		
6	Infrastructure	3.8932	0.301451	124.51	0.000	4.0690	0.535890	78.24	0.000	-1.1758	1.100450	2.27	0.133
		3.0352	0.816135			3.1111	0.856148			-0.9580	0.946640		
7	Library	4.1641	0.474173	305.41	0.000	4.3563	0.481688	116.11	0.000	0.7241	0.724179	8.10	0.005
		2.9531	0.624289			3.1150	0.960563			-1.2414	0.911369		
8	Placement and career counselling	4.0039	0.456778	200.92	0.000	3.7787	0.446930	111.11	0.000	-1.0781	0.791036	3.36	0.068
		2.9258	0.729280			2.8851	0.652371			-0.8937	0.675175		

Table 7   Levene's test homogeneity testing

Sn	Factors	For students' expectations and perception N = 128		For teachers' expectations and perception N = 87		For gap between students' teachers' expectations and perception		For gap scores of students and teachers of government and private institutes			
								Students (sample size government = 92, private = 36)		Teachers (sample size government = 66, private = 21)	
		Test static	P value	Test static	P value	Test static	P value	Test static	P value	Test static	P value
1	Academic excellence	101.11	0.000	11.84	0.001	0.14	0.709	1.07	0.303	0.02	0.892
2	Curriculum structure	55.85	0.000	28.46	0.000	0.40	0.529	15.63	0.000	0.00	0.951
3	Evaluation and reward	5.61	0.019	0.27	0.601	0.06	0.806	1.87	0.174	0.05	0.828
4	Financial autonomy	68.38	0.000	0.01	0.909	1.45	0.230	24.81	0.000	0.09	0.769
5	Faculty	13.05	0.000	16.26	0.000	0.66	0.416	1.28	0.260	0.93	0.338
6	Infrastructure	45.08	0.000	15.03	0.000	0.00	0.971	0.83	0.364	10.08	0.002
7	Library	5.83	0.016	9.12	0.003	4.43	0.036	0.00	0.979	0.31	0.582
8	Placement and career counselling	20.82	0.000	3.64	0.058	6.37	0.012	1.85	0.176	0.06	0.806

Table 8 T-test for comparison of gap scores of students and teachers of government and private institutes

Sn	Factor	Gap scores of students and teachers of government institutes				Gap scores of students and teachers of private institutes			
		Mean	Standard deviation	F value	P value	Mean	Standard deviation	F value	P value
1	Academic excellence	−1.0543	0.525485	100.99	0.000	−1.3364	0.461648	67.03	0.000
		−0.0833	0.389505			−0.3620	0.516213		
2	Curriculum structure	0.8207	0.521944	12.14	0.001	−2.1667	0.692450	9.59	0.003
		0.2360	0.952336			−1.6430	0.615282		
3	Evaluation and reward	0.5054	0.673251	6.33	0.013	−0.84091	0.582825	14.24	0.000
		0.1810	0.611237			−0.26190	0.700340		
4	Financial autonomy	1.0543	0.930130	3.61	0.063	−1.6970	0.858800	12.90	0.001
		0.5560	1.462770			−0.7620	1.480030		
5	Faculty	−0.9375	0.514388	129.56	0.000	−0.5530	0.560760	1.96	0.165
		0.2292	0.539096			−0.3100	1.012130		
6	Infrastructure	−1.1920	0.583103	105.43	0.000	−1.2780	0.830165	85.09	0.000
		0.0460	0.686157			0.0480	0.462910		
7	Library	−1.7011	0.624851	158.34	0.000	−1.6061	0.659342	88.14	0.000
		−0.1806	0.587401			−0.0950	0.583503		
8	Placement and career counselling	−1.4076	0.610932	101.79	0.000	−1.1170	0.548108	45.60	0.000
		−0.2361	0.534337			−0.1900	0.547179		

4.3.4.2 Descriptive statistics

The perception and expectation of stakeholders may vary based on conditions (Sahney, 2011a; Kinker et al., 2020). In such perspectives, the gap between perception and expectations of students and teachers based on several different criteria using means and percentages have been identified. The outcome indicated that the significant difference has been observed in all used criteria and shown in Table 5.

4.3.4.3 Hypothesis testing

The hypothesis test has been performed to answer the asked research questions in this study. As a part of the hypothesis test, the t-test has been performed to check if any disparity existed between the students and the teacher's group mean. Due to the large sample size and non-availability of population mean, the independent sample t-test has been performed. The result obtained from the analysis using the t-test is shown in Table 6. Further, the homogeneity of the groups to be compared is checked using Levene's test statistic to check the hypothesis. Items, with a p-value greater than 0.05, have been considered as homogeneous data groups. The findings of Levene's test are shown in Table 7. Moreover, to test the hypothesis, the means of the different constructs have been compared using one-way ANOVA; the pooled t-test for homogeneous datasets and Welch's t-test for non-homogeneous datasets has been performed. The overall service quality depends on eight 'must be' factors, the critical p-value for the significance test is determined based on Bonferroni adjustment for multiple hypothesis testing to control the family-wise error rate (FWER), this adjustment helps to control the probability of committing a type-I error (erroneous inference) for multiple comparisons. The result of the t-test for comparison of gap scores of students and teachers of government and private institutes is shown in Table 8.

5   Results and discussion

The study has been performed using average responses and the prioritisation of service quality factors using the Kano-methodology is taken separately for students and teachers of selected six case PEIs. Consequently, the level of satisfaction and dissatisfaction has been measured using the method suggested by Berger et al. (1993). The results of the Kano prioritisation based on the perspective of both students and teachers have been presented in Tables 2 and 3. The above-mentioned hypothesis has been checked using only 'must be' factors.

The results indicate that academic excellence, faculty, infrastructure, library and placement, and career counselling have been prioritised as 'must be' factors as per students' perspectives (Table 2). Whereas, factors academic excellence, curriculum structure, evaluation and reward, financial autonomy, infrastructure, and library have been prioritised as 'must be' factors in teachers' perspectives (Table 3). The set of eight factors can be seen as a union of mutually exclusive factors, classified as 'must be' by students only, teachers only, and teachers and students alike. The eight identified 'must be' factors are academic excellence, infrastructure, library, faculty, curriculum structure, placement and career counselling, financial autonomy, evaluation, and reward have been selected for further study. The gap between perception and expectations of

both stakeholders in terms of service quality of PEIs using the SERVQUAL and subsequently, hypothesis testing has been analysed. To test the validity of the construct, a reliability analysis of the factors has been carried out, followed by an analysis of the gap score and test of the hypothesis.

5.1 Reliability analysis

Reliability generally implies indicates whether or not respondents would give the same answer if the study is replicated and no states are modified (Gegez, 2010). The Cronbach's alpha model has been used as test of an internal consistency. This is an indication of the degree to that any dimension can be effectively measured by all items on a scale. The Cronbach alpha value of 0.7 and above is acceptable for service quality research (Nakip, 2006). The alpha values for perception and expectations of both students and teachers are within acceptable limits in this study (Table 4).

5.2 Descriptive statistics

The difference in the mean of perception and expectation gives the average gap score. A negative mean gap score indicates that the expectations of service quality are higher than the service quality perceived in real times. A higher negative gap score indicates a further need to improve in the overall service quality. The difference in mean of perceived and expected service quality perspectives has been identified. The difference in mean of perceived service quality and expected service quality is the highest for female teachers closely followed by the difference in means for male teachers (Table 5). The average gap score for female students is slightly higher compared to male students. It can be concluded that the difference in mean of expectation and perception is highest for teachers of UG qualification. For students studying in institutions located in urban areas, the average gap score is slightly higher compared to the students of institutes located in rural areas (Table 5). In addition, for teachers at government institutions, the gap score is high and for teachers at private institutes relatively low (Table 5).

5.3 Hypothesis testing

A significant difference in student perception and expectation scores has been observed and therefore rejects the null H1 hypothesis. The null hypothesis H2 rejects due to significant difference observed in the perceived service quality and expectations of teachers. There has been a significant difference in student and teacher view points on the quality of the services offered by PEIs and therefore reject the null H3 hypothesis. The null hypothesis H4 has been rejected due to significant difference observed in mean of gap scores for students of government and private institutes. Hypothesis H5 has been rejected because of the significant difference observed in the service quality to teachers of government and private institutions (Tables 6, 7 and 8).

6 Conclusions and future work

The aim of this study was to research the quality gaps of services given to PEI students and teachers and thus to identify the quality service factors that need to be concentrated

on improving PEIs. Initially, a full literature review and discussion with have identified 18 factors. These factors have been prioritised by using Kano model. Eight factors and 23 sub-factors these have been considered as 'must be' by either students or teachers or both. The service quality gap between perception and expectation has been analysed using the application of SERVQUAL and the hypothesis was tested for formulated five hypotheses.

Curriculum structure, evaluation and reward factors and financial autonomy have been observed to offer better quality of services than expected. The remaining factors need improvement in the quality of services from the students' perspective. It has been suggested that the need to improve the quality of academic excellence and library service from a teacher perspective is comparable to that of students. It has been noted that academic excellence, faculty, infrastructure, library, placement and career counselling needs to improve the quality of services provided by students from the perspective of government-funded PEIs compared to private-funded PEIs. It has been reported that, except for faculty service quality factors, the remaining factors need to improve the quality of services from the teacher perspective of government-funded PEIs compared to private funded PEIs. It has been pointed out from the perspective of teachers that quality of services needs improvement among all factors.

Significant differences in the quality of services have been observed in the perception and expectations of both students and teachers. Negative gap scores with a significant difference have been observed in the need to improve the quality of service factors in order to sustain the institutions in the current competitive market. The successful improvement and adaptation of these service quality factors will lead to the new enrolments and better job opportunities. The findings have been useful for administration, educational planners and policy makers in the field of PEIs. National Board of Accreditation (NBA) parameters are the most important consideration for formulation of new policies. It must correlate NBA parameters with defined service quality factors. In the future study, this correlation needs to be determined that will be helpful in prioritising NBA parameters and will make the work of policy makers relatively easier.

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