Analysis on the Influencing Factors of Subway Service Quality based on Passenger Satisfaction

Yan Chen[1], Yizhu Zhou[2], Wen Shi[3]
[1]Transportation College, Nanning University, Nanning, 530200, China
[2]The Board, Guangxi Wuzhou Communications Stock Co., Ltd., Nanning, 530028, China
[3]Ebusiness Department, Shanxi Jiahe Meisheng Information Technology Co., Ltd., Nanning, 530021, China

Abstract: Service quality management is not only the guarantee of subway passenger satisfaction, but also the requirement of industry standard management. Combining with the theory of service quality, this paper analyzes the characteristics of subway service quality, establishes the dimension and index system of the service quality scale, and carries out field survey, comprehensively uses the questionnaire method to evaluate the current situation of subway service quality, and uses factor analysis and other methods for analysis. According to the result of factor analysis, the main factors that affect the quality of subway service are the order, information service, service ability, service efficiency, and put forward countermeasures.

Keywords: Passenger satisfaction; Subway service quality; Influencing factors

1. Introduction

On April 8, 2019, issued by the Ministry of Transport service quality evaluation of urban rail transit management method ", the urban rail transit service quality "evaluation content includes passenger satisfaction evaluation, service support capability evaluation and operation service key indicators evaluation three parts", means that the passenger satisfaction become one of the important part of the subway service quality evaluation.

Subway passenger flow is large, how to improve the quality of service has become an important key to the subway operation. In recent years, many domestic experts and scholars have carried out researches on the influence of subway service quality, but their research direction is mostly from the perspective of subway or subway station service supply, and less from the perspective of passenger satisfaction.

Based on the service scale and combining with the characteristics of subway service quality, this paper takes nanning subway line as an example to investigate and analyze the main factors affecting subway service quality from the perspective of passenger perception, and puts forward countermeasures.

2. Characteristics of Subway Service Quality

Taking the passenger boarding process as the main line, the service process of nanning metro is as follows: guiding passengers to the station, queuing to buy tickets, security check, ticket checking into gate machine, platform waiting, bus, station transfer, exit gate machine (repaying tickets), and exit station. In the whole service process, the self-service of passengers is the main one, and the manual service is the auxiliary one. The quality of subway service will be comprehensively affected by equipment, personnel, environment and other factors.

In combination with the service process and the needs of passengers, the characteristics of subway service quality are as follows: (1) responsiveness, mainly reflected in whether the staff can provide active and timely service response to passengers to reduce the waiting time; (2) comfort refers to passengers' overall perception of the waiting environment, train operation and station after entering the subway station; (3) convenience, mainly reflected in whether passengers can get convenient and fast service; (4) reliability, that is, to provide services stably and reliably without any mistakes; (5) safety, that is, to protect the life and property of subway passengers from danger.
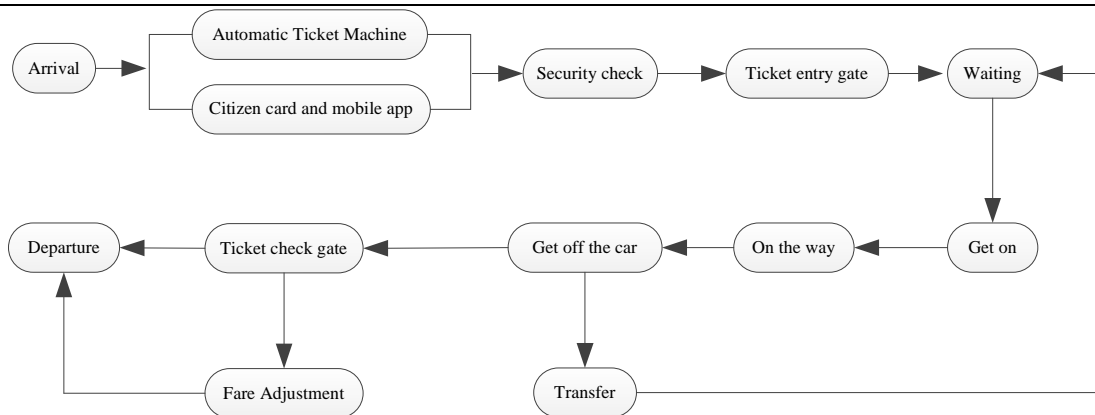
H K .N C C P

International Journal of Intelligent Information and Management Science
ISSN: 2307-0692, Volume 9, Issue 2, April, 2020

Figure 1. Flow chart of subway service

3. Index System of Subway Service Quality Evaluation based on SERVQUAL Model

3.1. Service quality evaluation tools

Parasurama as a classic model of service quality evaluation, SERVQUAL scale divides service quality into five dimensions: tangible, reliability, responsiveness, assurance and empathy. Then, customers score the expected value and actual perception value of each indicator one by one, calculate the difference between the two and get the difference score, and then get the service quality evaluation result.

Calculation formula: total score of SERVQUAL quality of service table (SQ) = actual perceived quality of service (Pi) - expected quality of service (Ei). Namely: the SQi = Pi – Ei.

When Pi > Ei, SQ > 0, indicates that the service meets more than expectations and the customer is satisfied.

When Pi = Ei, SQ=0, the service meets expectations and the customer is satisfied.

When Pi < Ei, SQ < 0, indicates that the service is not up to expectations, the customer is not satisfied. According to the calculation results, the SQ value is greater than zero and the larger the value, the higher the passenger satisfaction. If the SQ value is less than 0, the passenger is not satisfied.

3.2. Determination of dimension and evaluation index system of subway service quality

The establishment of the dimension of subway service quality evaluation should be based on passengers' subjective perception while riding the subway so as to reflect the effect of various services perceived by passengers during the subway ride. In view of the characteristics of subway service quality, the original five dimensions were modified into the five dimensions of "responsiveness, comfort, convenience, reliability and safety", and 23 indexes were refined to determine the evaluation index system.

Table 1. Evaluation scale of subway service quality

The dimension	Item number	Indicators
Responsiveness	1	Subway service personnel are well - groomed and dressed in uniform
	2	The attitude of the subway service staff (Including responsibility, initiative, behavior expression, patience and so on)
	3	Subway service personnel can timely and accurately answer passengers' questions
	4	When passengers need help, the subway staff can help them in time
	5	Subway service personnel have taken proper measures in case of emergency
Comfort	6	Subway trains run smoothly
	7	The train stops in good order
	8	The subway station and the train are clean and tidy
	9	Subway stations and trains are less crowded
Convenience	10	Short train time in and out of station
	11	The operation of ticket machine and citizen card recharging machine is simple, convenient and easy to understand. The queuing time is short
	12	There is a reasonable interval between morning and evening rush hours and non-rush hours
	13	Subway station transfer convenient, transfer signs and transfer direction guidance clear
	14	The subway line design is reasonable and it is convenient to change buses or other means of transportation
Reliability	15	Train arrival time can be provided when waiting in the station, and the train will arrive at the station on time

H K . N C C P

International Journal of Intelligent Information and Management Science
ISSN: 2307-0692, Volume 9, Issue 2, April, 2020

The dimension	Item number	Indicators
	16	Station announcements in metro stations and trains are timely and accurate
	17	The information of direction signs in subway stations is clear and accurate
	18	The ticket-checking machine senses the sensitivity of single-pass ticket, citizen card and mobile phone identification when entering or leaving the station
Security	19	Good order in and out of subway station
	20	Passengers can wait in line according to the sign when waiting at the platform
	21	The emergency evacuation signs in the station are clearly marked
	22	Accuracy and timeliness of advance notice when screen doors and train doors are about to open or close (broadcast/flashing etc.)
	23	The security condition in the subway station and in the carriage is good, without stealing or robbing

4. Service Quality Evaluation and Influencing Factor Analysis

4.1. Questionnaire design and field survey

In order to facilitate passengers to make subjective and reasonable evaluation and follow-up sorting, the questionnaire was graded at level 5, and the score of the questionnaire on service quality expectation was: 1 for very unimportant, 2 for not very important, 3 for general, 4 for relatively important, and 5 for very important. Actual perceived expectation of service quality questionnaire evaluation score: very unsatisfied score 1, not very satisfied score 2, general score 3, relatively satisfied score 4, very satisfied score 5.

A total of 200 questionnaires were sent out, among which 98 were men, accounting for 49%, and 102 were women, accounting for 51%. The proportion of men and women taking the subway was balanced. The majority of people who took the subway were between the ages of 18 and 30 (accounting for 90%), while the sample of people over 31 was relatively small, because more people were rejected when they asked to fill out the questionnaire. In terms of occupation, students and office workers take the majority of the subway [1].

4.2. Evaluation of subway service quality

According to the calculation formula of SERVQUAL model, the difference value scores of 23 indexes of the line were calculated, as shown in table 2. The weighted average method is used to calculate the difference value scores of each dimension, and the basic situation of service quality evaluation is obtained intuitively. It can be seen from table 3 that the service quality evaluation scores of each dimension are all less than 0, indicating that subway passengers fail to meet expectations in the perception of each dimension, and the improvement of service quality is imperative.

4.3. Analysis of main factors affecting perceived service quality

The actual perception questionnaire is a subjective evaluation conducted by passengers after experiencing subway services. After factor analysis, the main problems can be summarized.

After SPSS test, the KMO value was 0.909, greater than 0.9, and the correlation was very high. Bartlett spherical test coefficient was 0.000, less than 0.05, suitable for factor analysis. Then, SPSS22.0 software was used to analyze the principal component of the survey data and extract the factors.

Table 2. Service quality index score statistics table

The dimension	The title	The actual perception	Expect	Gap
Responsiveness	Subway service personnel are well - groomed and dressed in uniform	4.1	4.2	-0.1
	Service attitude of subway service staff (responsibility, initiative, behavior expression, patience)	4.06	4.38	-0.32
	Subway service personnel can timely and accurately answer passengers' questions	4.03	4.42	-0.39
	When passengers need help, the subway staff can help them in time	4.09	4.51	-0.42
	Subway service personnel have taken proper measures in case of emergency	4.07	4.63	-0.56
Comfort	Subway trains run smoothly	4.17	4.47	-0.3
	The train stops in good order	3.67	4.49	-0.82
	The subway station and the train are clean and tidy	4.14	4.52	-0.38
	Subway stations and trains are less crowded	3.46	4.1	-0.64
Convenience	Short train time in and out of station	3.79	4.08	-0.29
	The operation of ticket machine and citizen card recharging machine is simple, convenient and easy to understand. The queuing time is short	3.87	4.41	-0.54
	There is a reasonable interval between morning and evening rush hours and non-rush hours	3.72	4.37	-0.65
	Subway station transfer convenient, transfer signs and transfer direction guidance clear	3.98	4.51	-0.53
	The subway line design is reasonable and it is convenient to change buses or other means of transportation	3.96	4.47	-0.51
Reliability	Train arrival time can be provided when waiting in the station, and the train will arrive at the	4.14	4.44	-0.3

H K .N C C P

International Journal of Intelligent Information and Management Science
ISSN: 2307-0692, Volume 9, Issue 2, April, 2020

The dimension	The title	The actual perception	Expect	Gap
	station on time			
	Station announcements in metro stations and trains are timely and accurate	4.18	4.5	-0.32
	The information of direction signs in subway stations is clear and accurate	4.06	4.54	-0.48
	The ticket-checking machine senses the sensitivity of single-pass ticket, citizen card and mobile phone identification when entering or leaving the station	3.87	4.48	-0.61
Security	Good order in and out of subway station	3.89	4.44	-0.55
	Passengers can wait in line according to the sign when waiting at the platform	3.74	4.41	-0.67
	The emergency evacuation signs in the station are clearly marked	3.98	4.6	-0.62
	Accuracy and timeliness of advance notice when screen doors and train doors are about to open or close (broadcast/flashing etc.)	4.16	4.57	-0.41
	The security condition in the subway station and in the carriage is good, without stealing or robbing	4.16	4.51	-0.35

Table 3. Service quality score table of five dimensions

The dimension	Actual perceptual mean	Expected mean	Gap value
Responsiveness	4.07	4.43	-0.36
Comfort	3.86	4.40	-0.54
Convenience	3.86	4.37	-0.51
Reliability	4.06	4.49	-0.43
Security	3.99	4.51	-0.52

Table 4. Analysis of actual perceived service quality factors

The dimension	Component			
	1	2	3	4
P20.When waiting at the platform, passengers can consciously queue according to the signs	0.853			
P19.Good order in and out of the subway station	0.788			
P7.Get on and off the train in good order when it stops	0.748			
P21.Clear and eye-catching emergency evacuation signs in the station	0.661			
P18.Sensitivity of one-way ticket, citizen card and mobile phone identification when the ticket machine enters and leaves the station	0.584			
P17.Clear and accurate information of direction signs inside and outside the subway station	0.557			
P14.The design of metro lines is reasonable, and it is convenient to transfer buses or other means of transportation	0.492			
P13.The transfer in the subway station is convenient, and the transfer sign and direction guidance are clear	0.492			
P16.The contents of broadcasting in the subway station and in the train shall be timely and accurate		0.805		
P22.Accuracy and timeliness of advance notice when PSD and train door are about to open or close (broadcast / flashing light, etc.)		0.799		
P23.The public security in the subway station and carriage is in good condition without stealing or robbing		0.739		
P23.The train arrival time can be provided in time when waiting in the station, and the train arrives on time		0.650		
P1.The appearance of the iron service staff is neat and elegant, and the dress is uniform			0.805	
P5.The emergency measures of subway service personnel in case of emergency are properly handled			0.766	
P2.Service attitude of metro service personnel (including sense of responsibility, initiative, behavior expression, patience, etc.)			0.760	
P3.Metro service personnel can answer the passenger's questions timely and accurately			0.752	
P4.When passengers need help, the subway service personnel can help them in time			0.750	
P11.The operation of ticketing machine and citizen card recharge machine is simple and easy to understand, and the waiting time is short				0.707
P10.Short time for train to and from the station				0.661
P12.Reasonable departure interval between morning and evening peak and off peak hours				0.638
P9.Less congestion in metro stations and trains				0.620
P8.The subway station and the train are clean and tidy				0.611
P6.Smooth operation of metro train				0.499

Note: P stands for perceived service quality evaluation
According to the above-mentioned five actual perceived service quality factor analysis in the table can be summed up the four main factors: see P20 (passenger station waiting order) and P19 (in and out of the station order), P 7(hop on and off the train stop order) and the station is close to the logo and factor between the direction of 1, is all about riding to order, which is available to order the

H K .N C C P

International Journal of Intelligent Information and Management Science
ISSN: 2307-0692, Volume 9, Issue 2, April, 2020

passengers in the subway when the main factor affecting the perceived service quality. Factor 2 is closely related to the information service of the subway station, which is reflected in the information service provided by the station to passengers, such as real-time train arrival time and broadcast information, transfer route and surrounding bus information, or broadcast lights to remind passengers of safety, etc. Information service is indispensable in travel and can play a guiding and prompting role in self-service. Factor 3 mainly indicates the service capacity of the subway station, that is, the subway staff can timely and effectively provide help to passengers when they need help, and the emergency ability of the subway staff in case of emergency. Factor 4 is closely related to the service efficiency of subway stations, which is mainly reflected in ticket queuing, departure interval, environment, etc. Effectively improving the service efficiency of the subway station can save travel time and improve travel efficiency for passengers.

To sum up, the main factors affecting subway passengers' perception of service quality can be summarized into four aspects: "train order, information service, service capability and service efficiency". Countermeasures will be proposed from these four aspects to improve subway service quality.

5. Service Quality Evaluation and Influencing Factors Analysis of Subway Service Quality Improvement Strategy

5.1. Train order and guidepost

5.1.1. Strengthen the orderly guidance of passengers entering the platform and waiting for the train

Reasonable planning of passengers getting on or off the path can effectively avoid the happening of hedge traffic situation, save boarding time, improve efficiency, or according to station passenger flow forecast and actual situation, the passenger volume larger sites (for example: the train station, chaoyang square station, guangxi university station, the train station, etc.) add on subway service staff to ease of passenger train platform, the waiting line indicator on the ground, cannot attract the attention of the passengers, the subway station waiting queue indicator should be attached to the sliding door on both sides, or strengthen the propaganda, broadcast tips and drove civilization make passengers form after the first on good behavior habits.

5.1.2. To increase the clarity and distinctiveness of the station guidelines

In the process of taking the subway, the guide signs guide passengers to travel and throughout the whole journey, playing a role in informing passengers of information. Therefore, in order to improve the practicability of guid-

ing signs, the subway operating enterprises should constantly strengthen the construction of guiding signs inside and outside subway stations, so as to facilitate passengers to ride, and should set up signs from the perspective of passengers. Subway operators can invite citizens of all classes and ages who seldom take the subway or have never taken the subway to have a trial ride, collect Suggestions, perfect the setting of guide signs, and improve the practicability of guide signs [2].

5.2. Information services and security at MTR stations

5.2.1. Strengthen the broadcast warning in stations and trains

The information service is mainly embodied in the radio prompt in the station and in the train. The radio in the train can serve as a reminder to passengers. The radio will be broadcast when the train is about to arrive to prevent passengers from getting off the wrong train. Subway stations should strengthen the broadcast voice prompts to prevent passengers from getting on the wrong bus, getting off the wrong station, or missing a station.

Nanning subway station can adopt three languages: Chinese, English and vernacular, because vernacular belongs to the characteristics of nanning. On the one hand, it is to increase local characteristics and protect vernacular culture; on the other hand, it is to facilitate the travel of some old people.

5.2.2. Uncivilized behavior and obstruction of passengers in the carriage

In terms of public security, it is suggested that the MTRC should enhance the station public security situation and arrange a staff member to patrol the train carriages within its capacity, which can reduce the occurrence of theft and robbery, as well as the uncivilized behavior of some passengers on the subway and stop them from obstructing other passengers. For example, in a subway line,a few passengers used to beg other passengers on the train and sing songs with loudspeakers, which affected other passengers' rest. According to the investigation, it is not the first time that this kind of situation has occurred. If there are staff in the carriage to carry out patrols, this kind of situation can be effectively eliminated.

5.3. Service capacity of subway stations

Factors affect the ability of the subway service performance in terms of staff service attitude, arrange for subway service workers change jobs site, always maintain the freshness and enthusiasm of work, strengthen the first-line service staff business ability and service consciousness training, master professional knowledge and relevant knowledge, active, enthusiastic service for passengers, passengers can enjoy the good service experience.

H K . N C C P

International Journal of Intelligent Information and Management Science
ISSN: 2307-0692, Volume 9, Issue 2, April, 2020

5.4. Service efficiency of MTR stations

5.4.1. The queuing time for ticket purchase is long, and some passengers will not buy tickets

In consideration of the large number of passengers in subway stations, toilets should be added in the station hall with large passenger flow to facilitate passengers and subway staff. For the convenience of buying tickets in the station hall to increase ticket machine or mobile APP, such as nanning rail transit APP and love nanning APP, brush qr code in and out of the station or bluetooth recognition car in and out of the station, cloud gate, can achieve scan code into the brake paid out of the gate, promotion network ticket, you can collect the tickets in the station to increase network machine (FAM), and so on, improve the efficiency of passenger travel.

For passengers who do not know how to purchase tickets, a simple ticket purchase operation flow chart or ticket purchase video (Chinese and English) can be set up next to the ticket machine, so that passengers can get help in time and reduce staff duplication.

5.4.2. Slow security check during peak passenger flow

Before the holidays can be carried out on the passenger flow forecast or according to actual traffic conditions (for example, a fixed period of time every day morning and evening rush hour), can adjust security position reasonable or appropriate increase security personnel, directing passengers to stand in other security checkpoints, increase security channel quickly, through the bypass security to reduce passengers queue security time, reduce the time passengers queue security checks, can be installed above the security check point location or display, broadcast video dispersed attention passengers. In the holiday passenger flow is very large circumstances can be taken to alleviate the station pressure and security measures.

5.4.3. Departure interval between holidays and peak periods

During the holidays and the morning and evening rush hours, we can reduce the interval time, increase the frequency, increase the carrying capacity or increase the waiting seats in the platform. We can also play light music to relieve passengers' waiting fatigue.

6. Conclusion

Based on the theoretical model of service quality, this paper USES the investigation analysis method to conclude that the main factors affecting passengers' perception of subway service quality are "train order, information service, service ability and service efficiency", and puts forward improvement strategies with realistic concern. However, due to the limitation of survey data, it remains to be further studied whether the evaluation results are in place or not, and which evaluation method is more objective and reasonable to evaluate the subway service quality.

7. Acknowledgments

References

[1] Cao Canming, Chen Jianjun. Analysis on service quality, passenger satisfaction and passenger loyalty relationship of high-speed railways. Journal of the China Railway Society. 2012, 34(1), 1-6.

[2] Gour C. Saha, Theingi. Service quality, satisfaction, and behavioural intentions. Managing Service Quality: An International Journal. 2009, 19(3), 350-372.