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MODELING THE QUALITY OF SERVICES OF HIGHER EDUCATION INSTITUTIONS IN THE CONTEXT OF SUSTAINABLE COMPETITIVENESS

Abstract: The goal of the conducted research was to model the elements affecting the quality of services provided by faculties in the Republic of Serbia. The research was conducted on a sample of 1,212 students of both genders from 13 higher education institutions of the University of Belgrade, University of Niš, and University of Kragujevac. The analysis of the collected data was done using Rasch item analysis and Structural Equation Modeling (SEM) analysis. The results showed that the analyzed model had good characteristics and that the applied questionnaire, with small changes in the item structure, can be used as a suitable instrument for assessing the quality of services provided by a higher education institution. Further evaluation of the applied model and questionnaire should be directed toward harmonizing the number of items by factors and meeting the requirements for better reliability of respondents' separation. The theoretical foundation of this study is grounded in service quality models in higher education, which assume that user satisfaction is shaped through the interaction of academic and non-academic resources, the characteristics of study programs, and the institution's reputation and image. The obtained findings confirm the relevance of this theoretical framework, as they highlight the multidimensional nature of service quality and justify the application of an integrated model in interpreting perceptions of quality within higher education institutions in the Republic of Serbia.

Keywords: higher education institutions, questionnaire, structural model, service quality.

1. Introduction

The assessment of educational service quality, along with the development of reliable measurement instruments, has attracted considerable scholarly attention in recent years (Dunić & Dragović, 2025; Farooq & Khan, 2024; Jadrić et al., 2025; Musandiwa & Rikhotso, 2024; Nutsugah et al., 2025; Supriyanto et al., 2024). Much of this research has focused on adapting standardized measurement frameworks initially developed for profit-oriented sectors and tailoring them to the specific characteristics of higher education. In parallel, numerous studies have examined the relationship between perceived service quality and student satisfaction, as well as the influence of service quality perceptions on students' behavioral intentions and future decision-making processes (Del Río-Rama et al., 2021; Ngo et al., 2025; Seitova et al., 2024; Thanh & Nguyen, 2025). Collectively, these findings demonstrate sustained academic interest in the field and reflect a prevailing consensus - particularly among scholars with an economic perspective - that students can be conceptualized as service consumers, thereby reinforcing a market-oriented view of higher education.

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Recent literature further emphasizes the strategic importance of quality in higher education as a determinant of global competitiveness (Goretzko et al., 2024; Seitova et al., 2024). Over the past two decades, higher education systems have experienced profound transformations at national, regional, and international levels, generating an increased demand for effective management practices aimed at improving students' perceptions of service quality (Maisonnave & González, 2024). According to Dinh et al. (2021), the adoption of innovative managerial and operational approaches, aligned with evolving stakeholder expectations, has encouraged higher education leaders to implement structural reforms and adapt educational systems accordingly.

Education represents a fundamental pillar of national development. Alonso-Almeida et al. (2024) emphasize the strong interdependence between educational advancement and economic growth. Globally, human capital is widely recognized as a key driver of economic performance, and investments in education contribute significantly to long-term national prosperity (Amoozegar et al., 2025). As demand for higher education continues to rise and awareness of alternative educational opportunities grows, students and other stakeholders have developed increasingly sophisticated expectations regarding educational service providers (Zakirullah et al., 2025). Consequently, the education sector fulfills a dual role: supporting economic development while simultaneously shaping the competencies and values of future generations (Seitova et al., 2024).

Employers often perceive graduates of higher education institutions as lacking essential skills and competencies, a view that poses a significant obstacle to their employability in the labor market (García-Álvarez et al., 2022). Additionally, globalization and rapid technological advancement have increased the demand for interdisciplinary expertise, while contemporary teaching methods and digital learning tools have significantly raised the cost of education. The ongoing expansion of higher education institutions has further intensified competition within the sector, highlighting the competitive advantage of institutions that consistently deliver high-quality educational services (Bartolo & Tınmaz, 2024).

It is important to note that the database used in this study was previously analyzed by Dunić et al. (2025). That research employed a Multilayer Perceptron (MLP) neural network to develop a predictive model of student satisfaction based on five service quality factors. Although the predictive capability of the model was validated, the psychometric properties and internal structure of the measurement instrument were not the primary focus of the earlier study. Consequently, the present study aims to build on those initial findings by shifting the focus from prediction to measurement validation. Using Rasch analysis and Structural Equation Modeling (SEM), we assess the construct validity, dimensionality, and item functioning of the 34-item questionnaire. This approach provides a deeper understanding of how each factor influences perceived quality in higher education institutions, which is a critical step prior to further refinement of the instrument for broader application.The central research problem addressed in this study focuses on examining the psychometric and structural characteristics of a questionnaire developed on the basis of a hypothetical model that captures the key factors influencing students' perceptions of higher education service quality in Serbia, as well as their overall satisfaction with the services provided.

Maisonnave & González (2024) emphasize that teaching staff play an extremely important role in the operations of a higher education institution and are largely responsible for the degree of student satisfaction. Consequently, we suggest:

Hypothesis H1: The quality of the faculty's teaching staff positively affects students' opinions about the faculty and their satisfaction with studying.

Iqbal et al. (2024) found that student service workers and non-teaching staff directly influence students' perception of the overall quality of the institution. Students tend to focus primarily on

the friendliness of non-teaching staff, while often overlooking the complexity and importance of their work, and whether their activities significantly impact the institution's overall quality and operations (Al Hassani & Wilkins, 2022; Iqbal et al., 2024; Serrano et al., 2025).

Hence, we suggest:
Hypothesis H2: The quality of the faculty's non-teaching staff positively affects students' opinions about the faculty and their satisfaction with studying.

Research has been conducted on factors that may influence the attraction, satisfaction, and retention of students. Li et al. (2025) indicate that, from the students' perspective, quality education provides better learning opportunities and suggests that the level of satisfaction or dissatisfaction significantly contributes to students' success or failure in learning. De Juan Vigaray et al. (2024) and Wong & Chapman (2023), emphasize that higher education institutions focus on identifying and meeting the needs and expectations of their students (Khabusi et al., 2025; Marques et al., 2025). Amiri et al. (2025) analyzed correlations between various elements of higher education institutions and student satisfaction, arriving at similar conclusions. They noted that the quality and design of study programs were most strongly associated with student satisfaction, while correlations with the practical application of acquired knowledge were slightly lower.

Thus, we suggest:
Hypothesis H3: The quality of the faculty's study programs positively affects students' opinions about the faculty and their satisfaction with studying. The reputation of a higher education institution is used to investigate the quality of provided services, student satisfaction, and loyalty through the examination of the following constructs: impression, reputation, and comparative advantage (Abdullah et al., 2000; Hasan & Hosen, 2022).

Thus, we suggest:
Hypothesis H4: The faculty's reputation positively affects students' opinions about the faculty and their satisfaction with studying.

Higher education institutions are predominantly interested in developing and maintaining a positive image, which is supposed to affect the choice of future students. Students gain experience related to a higher education institution, which is based on the study program on the one hand and on the higher education institution, on the other hand. Building an image is of crucial importance for attracting and retaining students, simultaneously representing an important trigger of student satisfaction (Bajaj & Arya, 2022; Del Río-Rama et al., 2021; Ngo et al., 2025; Nguyen et al., 2025; Thanh & Nguyen 2025).

Hence, we suggest:
Hypothesis H5: The faculty's image positively affects students' opinions about the faculty and their satisfaction with studying.

Bearing the results of previous research related to the problem of factors affecting the quality of services and student satisfaction in mind, a hypothetical model was defined with 5 factors that influence student satisfaction: quality of teaching staff, quality of study programs, quality of non-teaching faculty staff services, faculty's reputation and faculty's image. Based on the five suggested research hypotheses, a conceptual model of positive effects was formulated (Figure 1).

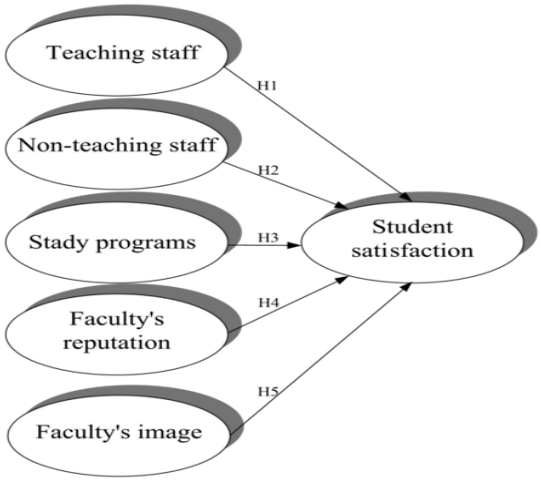

Figure 1. *Conceptual model*

It is crucial to comprehend the customer satisfaction model, along with the segments that influence it, how it is assessed, and the methods by which companies can improve consumer satisfaction. Consumer satisfaction can be defined as the consumer's emotional response, or rather satisfaction, which can occur by comparing the expectations created before the purchase, i.e. seen and understood performance of products/services. Consequently, higher education institutions strive to enhance their offerings, intending to generate a possible impact regarding the attraction of a greater number of individuals of users, resulting in their satisfaction (Bajaj & Arya, 2022; Del Río-Rama et al., 2021; Ngo et al., 2025; Nguyen et al., 2025; Thanh & Nguyen 2025).

2. Methods

2.1. Participants

The research sample consisted of 1,212 students from Serbian public universities in Belgrade, Niš, and Kragujevac, who voluntarily completed an online survey. More than two-thirds of the sample were female (70.4%), while male respondents accounted for slightly less than one-third (29.6%). Regarding age, the majority of respondents (91.1%) were between 18 and 25 years old. Most students were enrolled in undergraduate programs (94.2%), while 6.8% were pursuing master's or doctoral studies (Table 1). In terms of academic disciplines, over half of the respondents (58.3%) were engaged in social sciences and humanities, 23.8% in technical and technological sciences, and smaller proportions studied medical sciences (0.4%) or arts (1.3%). Concerning students' residence during their studies, the majority (80.2%) lived in the city where their faculty is located, while slightly less than one-fifth (19.9%) commuted from home. Regarding employment, most students (70.3%) were not employed, 20.0% had temporary or part-time jobs, and 9.7% were employed full-time (Table 1).

Table 1. *Participants' Demographics*

Demographic characteristics	Frequency	Cumulative Percent
Gender		
Male	359	29.6
Female	853	70.4
Total	1212	100

Age		
18-25	1104	91.1
26-30	66	5.4
>30	42	3.5
Total	1212	100
Study level		
Undergraduate Study	1142	94.2
Master's Study	52	4.3
Doctoral Study	18	1.5
Total	1212	100
Field of Study		
Mathematics and natural sciences	198	16.3
Technical sciences	288	23.8
Humanities	706	58.3
Medical science	4	0.4
Art	16	1.3
Total	1212	100
Place of living		
Campus	971	80.1
Other city	241	19.9
Total	1212	100
Employment Status		
Part-time job	243	20.0
Permanent job	117	9.7
Unemployed	852	70.3
Total	1212	100
Mothers' education level		
Primary School	94	7.8
High School	737	60.8
College	187	15.4
Faculty	148	12.2
Master/Doctorate	46	3.8
Total	1212	100
Fathers educational level		
Primary School	77	6.4
High School	755	62.3
College	155	12.8
Faculty	184	15.2
Master/Doctorate	41	3.4
Total	1212	100

Source: Authors

The data for this study were collected through a survey of 1,212 students from 13 higher education institutions, including the University of Belgrade, University of Niš, and University of Kragujevac. The same dataset was previously used in Dunić et al. (2025) for predictive modeling purposes. The questionnaire consisted of 34 statements covering five key dimensions of service quality: teaching staff, non-teaching staff, study programs, faculty reputation, and faculty image. In the present study, Rasch analysis and SEM were applied to evaluate the psychometric properties and construct validity of the proposed measurement model.

2.2. Measuring instrument

A questionnaire with statements and answers offered in the form of a five-point scale was used as a basic instrument in data collection: 1- completely disagree; 2 - disagree; 3 - I have no opinion; 4 - agree; 5 - completely agree. The applied questionnaire was created for the current paper based on the instruments presented in related research conducted in higher education institutions (Dunić & Dragović, 2025; Farooq & Khan, 2024; Toscano-Hernández et al., 2024).

The questionnaire contained an introductory part in which basic demographic data were collected: gender and age of the respondents, level of study, field of study, place of residence during studies, employment during studies and information on parents 'education. In its fundamental part, the questionnaire contains 34 statements covering five hypothetical factors for evaluating the quality of services:

The quality of the faculty's teaching staff was measured using 10 statements addressing the quality of lectures, accuracy and organization of teaching activities, staff availability, and the support provided to students in overcoming academic challenges encountered during their studies.

The quality of the faculty's non-teaching staff was assessed through 6 statements focusing on the accessibility of faculty services, staff friendliness, professionalism, and the adequacy of information provided by administrative services.

The quality of the faculty's study programs was evaluated using 4 statements referring to overall program quality, program innovativeness, availability of information about study programs, and the applicability of the knowledge acquired.

The faculty's reputation was measured using 4 statements related to its status in society, students' safety, the trust employees instill in students, and the extent to which the faculty fulfills its promises.

The faculty's image was assessed through statements referring not only to reliability, but also to employee innovativeness, contribution to society, institutional prestige (i.e., the prominence of the higher education institution), and the quality of relationships with students.

Student satisfaction was measured using 6 statements addressing perceived service quality, knowledge gained, fulfillment of educational and career goals, and the intention to continue education at higher levels of study.

2.3. Statistical analysis

Basic descriptive statistics were calculated for the questionnaire items as the first step in the statistical analysis. Response frequencies for each item and the percentage distribution across response categories were determined. Subsequently, the mean and standard deviation were calculated for each questionnaire item. The internal consistency of the items corresponding to each hypothesized latent variable was assessed using Cronbach's alpha coefficient. The closer Cronbach's alpha is to 1, the greater the internal consistency among the items. However, it should be noted that Cronbach's alpha tends to increase with test length. A value of $\alpha > .70$ indicates acceptable reliability (Wang & Wang, 2023), $\alpha > .80$ indicates high reliability, and $\alpha > .90$ indicates very high reliability (Raykov & Marcoulides, 2022; Wong & Chapman, 2023).

The reliability of Pearson separation and the fit of items to the hypothetical measurement model were examined using the mixed Rasch model implemented in R (Avinç & Doğan, 2024; Getenet et al., 2024; Gleeson et al., 2023). As part of this analysis, the Mean Square Error (MSE), the Pearson Separation Reliability (PSR) coefficient, and the Outfit statistics for the questionnaire items were

calculated. An acceptable range of 0.6–1.4 was used for the Outfit statistic (Bell et al., 2024). These indices were also used for item selection, that is, for defining the final set of valid items for each analyzed independent variable.

Analysis of the relationships and structure of the variables in the hypothetical measurement model was performed using SEM analysis. Maximum likelihood estimation with random permutation was applied. Model fit was evaluated by determining the value and statistical significance of the chi-square test, as well as the absolute fit index Root Mean Square Error of Approximation (RMSEA). A cutoff value of 0.08 was used to assess the acceptability of RMSEA (Beribisky & Hancock, 2023; Brown & Smith, 2023). Additionally, the Comparative Fit Index (CFI), Tucker–Lewis Index (TLI), Bentler–Bonett Normed Fit Index (NFI), Bollen's Relative Fit Index (RFI), and Bollen's Incremental Fit Index (IFI) were calculated as supplementary fit indices. A cutoff value of 0.90 was considered acceptable for these indices. The relationships between the dependent variable and the predictors were assessed by calculating standardized beta coefficients and testing their statistical significance. The overall relationships among the analyzed variables are presented in the path diagram.

Basic descriptive statistics were computed using the SPSS 20.0 software (IBM SPSS Statistics; License ID: 729225). Item analysis was conducted using the Jamovi statistical software (The jamovi project) (Lee, 2021; Sözer Boz, 2025). Jamovi is open-source software that functions both as an independent statistical platform and as an interface for implementing relevant R packages. Item Response Theory (IRT) analysis was performed using IRTPRO 4.7.4. The SEM analysis was conducted using AMOS 24.0.0 (Build 596938). For all statistical tests, the level of significance was set at $p \leq .05$ (Avinç & Doğan, 2024; Gleeson et al., 2023).

3. Results

The analysis of the basic descriptive statistics of the questionnaire (Table 2) showed that the average value for all items was above 3, mostly above 4, which indicates a negative asymmetry of the distribution of results. This is also confirmed by the distribution of responses by item, where a high percentage of responses on scale values 4 and 5 can be observed. Students had affirmative attitudes to the provided statements and highly rated all included aspects of attitudes towards studies, faculties, teachers and workers.

Table 2. *Basic descriptive statistics of items and distribution of scale values*

Item	Mean	Standard deviation	Scale value distribution (%)				
			1	2	3	4	5
TCR_1	4.41	.785	0.3	2.5	9.3	31.6	56.3
TCR_2	4.12	.933	1.1	5.7	14.8	37.2	41.3
TCR_3	4.17	.859	0.4	4.3	14.4	39.4	41.5
TCR_4	4.31	.907	1.2	4.2	10.8	29.9	54.0
TCR_5	4.00	1.054	2.7	7.1	17.7	32.1	40.4
TCR_6	4.35	.841	0.7	2.7	11.8	30.6	54.2
TCR_7	3.82	1.099	3.2	10.2	20.8	32.7	33.1
TCR_8	4.45	.788	0.8	2.0	7.8	30.3	59.2
TCR_9	3.82	1.086	3.4	9.2	21.8	34.0	31.6
TCR_10	4.05	.988	2.3	5.6	15.5	37.5	39.0
OFC_1	3.93	1.057	3.0	8.2	17.2	36.2	35.4
OFC_2	4.05	1.050	3.1	6.4	15.2	33.7	41.6
OFC_3	4.06	.963	1.7	5.1	17.8	36.1	39.2

OFC_4	3.89	1.165	5.0	8.5	18.0	29.0	39.5
OFC_5	3.66	1.254	7.5	12.7	18.0	29.7	31.9
OFC_6	4.03	1.066	3.8	5.1	17.3	32.0	41.7
PRG_1	4.53	.745	0.4	2.6	5.1	27.1	64.9
PRG_2	4.35	.835	0.6	4.0	7.9	34.9	52.6
PRG_3	4.10	.969	1.4	5.6	17.2	33.3	42.4
PRG_4	3.99	1.102	3.4	8.6	15.1	31.4	41.6
REP_1	4.19	.956	2.0	3.5	15.5	31.8	47.2
REP_2	4.00	1.035	2.4	7.2	17.6	33.7	39.2
REP_3	3.98	1.053	2.1	8.7	17.7	32.3	39.1
REP_4	4.55	.768	1.0	2.1	4.7	25.2	67.0
IMG_1	4.28	.958	2.0	4.6	10.1	30.4	52.9
IMG_2	4.02	1.032	2.6	6.6	17.2	33.7	39.9
IMG_3	3.68	1.181	5.7	10.2	25.9	26.7	31.4
IMG_4	3.74	1.112	3.9	8.7	28.6	26.9	31.8
SAS_1	4.08	.958	1.1	7.6	12.9	38.9	39.5
SAS_2	4.16	.930	1.4	5.1	12.8	37.7	43.0
SAS_3	4.17	.921	0.7	4.8	17.0	32.1	45.4
SAS_4	4.09	.952	1.2	6.5	14.1	38.1	40.0
SAS_5	3.87	1.139	4.4	9.3	18.1	31.5	36.7
SAS_6	3.89	1.377	11.5	6.0	14.3	19.0	49.3

Source: Authors

The average values of the composite variables obtained by condensing the items based on the hypothetical model of the questionnaire had a value ranging from 3.93 to 4.15 with satisfactory values of the standard deviation (Table 3). A negative asymmetry was also found for these variables with skewness values ranging from -0.7 to 1.0, which represents the upper limit of acceptable values. The correlation coefficients of all pairs of variables are positive and high, which indicates the same object of measurement. This is also confirmed by the value of Cronbach's alpha internal consistency coefficient (Shen & Wang, 2023), which is above 0.80 for all variables. Correlations of the dependent variable Student satisfaction with all independent variables are high, above 0.70, except for the variable The quality of the faculty's non-teaching staff.

Table 3. *Basic statistics and correlations of variables*

Varijable	Mean	Standard deviation	Correlation					Cronbach α
			TCR	OFC	PRG	REP	IMG	
The quality of the faculty's teaching staff	4.15	0.69	-					0.91
The quality of the faculty's non-teaching staff	3.93	0.87	0.634	-				0.88
The quality of the faculty's study programs	4.24	0.74	0.649	0.512	-			0.83
The faculty's reputation	4.18	0.79	0.733	0.625	0.716	-		0.84
The faculty's image	3.93	0.95	0.593	0.484	0.716	0.748	-	0.91
Student satisfaction	4.04	0.89	0.707	0.560	0.753	0.794	0.800	0.93

Source: Authors

3.1. Item analysis

Before analyzing the structure and relationships among the variables, item analysis was conducted using the mixed Rasch model, which assesses the reliability of Pearson separation (Table 4). The highest reliability of separation was observed for the variables *Quality of teaching staff*, *Faculty's image*, and *Student satisfaction*, all exceeding 0.80, which is considered indicative of good Pearson separation reliability (Beribisky & Hancock, 2023; Brown & Smith, 2023). The variable *Quality of non-teaching staff*, despite its high MSE value, demonstrated satisfactory separation reliability. In contrast, the variables *Quality of study programs* and *Faculty's reputation* exhibited weaker separation reliability.

For the variable *Quality of the faculty's teaching staff*, Rasch analysis of the items showed that most Outfit values were below 1, mostly around 0.6, indicating higher predictability of the results than expected (Ruan et al., 2023). The MSE value was low, suggesting that this variable contributes less to the measurement model and may produce spurious separation reliability values. Items 1 and 3 had Outfit values below 0.6 and were therefore removed from further analysis. The reported reliability coefficient was calculated after removing these items. For the variables *Quality of study programs*, *Faculty's reputation*, and *Faculty's image*, Outfit values were closer to 1, indicating a good fit with the model, with MSE values within the productive range (0.6–1.4). No item reduction was necessary for these variables.

Table 4. *Pearson separation reliability and Outfit measure using Rush model*

Variables/Items	MSE	PSR	Outfit measure									
			1	2	3	4	5	6	7	8	9	10
The quality of the faculty's teaching staff	0.441	0.861	**0.57**	1.06	**0.47**	0.83	0.69	0.67	0.67	0.66	0.64	0.66
The quality of the faculty's non-teaching staff	**2.101**	0.702	0.60	0.60	**0.48**	0.71	0.64	**1.66**				
The quality of the faculty's study programs	0.604	0.615	1.42	0.73	0.75	1.14						
The faculty's reputation	0.621	0.659	1.32	0.74	0.88	1.04						
The faculty's image	0.672	0.811	1.14	0.93	0.81	0.91						
Student satisfaction	0.698	0.857	0.64	0.64	0.83	0.60	0.78	**1.88**				

MSE - Mean square error; PSR – Pearson separation Reliability

Source: Authors

The variable *Quality of non-teaching staff* exhibited a very high MSE value, indicating that it might contribute to the degradation of the measurement model. To reduce the influence of estimation error, the third and sixth items of this variable were removed from further analysis. Specifically, the third item had an Outfit value below the acceptable limit, while the sixth item exceeded the upper limit of acceptability. Regarding the dependent variable *Student Satisfaction*, Rasch analysis revealed that item 6 had an Outfit value above the upper acceptable limit, potentially distorting the assessment of this variable; therefore, it was excluded from further analysis. All other items displayed Outfit values within acceptable limits.

3.2. SEM analysis

Structural equation modeling (SEM) is a statistical method used to establish and test causal relationships by combining statistical data with qualitative causal assumptions. While SEM shares similar goals with multiple regression, it provides a broader approach, as it accounts for interactions, non-linearity, correlated independent variables, and measurement error. SEM can also serve as a powerful alternative to multiple regression, path analysis, factor analysis, time series analysis, and covariance analysis (Caemmerer et al., 2024; Liengaard, 2024). The hypothetical model underlying the applied questionnaire included five independent variables—faculty teaching staff, faculty non-teaching staff, faculty study programs, faculty reputation, and faculty image—and one dependent variable: student satisfaction. We tested this model and examined the relationships between student satisfaction and the predictor variables using the SEM method (Zhang et al., 2023).

The SEM analysis was conducted based on a hypothetical model that initially included 28 independent variables, which were later reduced to 25 after the preliminary analysis. However, the model with 25 variables could not be properly identified in the SEM analysis, and even after forced fitting, it exhibited weak characteristics. The RMSEA value was 0.210, well above the acceptable threshold, and all other fit indices were below the desirable value of 0.90. After removing variables with low communalities ($R^2 \leq 0.40$), a final model consisting of 20 variables was developed through several iterations (Figure 1). SEM analysis indicated that this set of items adequately fit the hypothetical latent variable model, as evidenced by a statistically significant Chi-square test ($\chi^2 = 1876.1$; $df = 260$; $p < 0.001$). This was further supported by the RMSEA value, which fell below 0.08 (Table 5), generally indicating good model fit (Goretzko et al., 2024). RMSEA values above 0.1 are typically considered indicative of an unacceptable fit (Goretzko et al., 2024; Liengaard, 2024; Matsunaga, 2022). Additionally, the Akaike Information Criterion (AIC) is destimator of prediction error and tool for model selection. AIC decreased from 3499.20 in the 25-variable model to 2056.08 in the final 20-variable model, reflecting an improved model fit.

Table 5. *Basic fit indices*

RMSEA	90% Confidence Intervals		RMSEA p
	Lower	Upper	
0.075	0.072	0.078	< 0.001

RMSEA - Root Mean Square Error of Approximation;
RMSEA p - statistical significance

Source: Authors

Additional fit indices (Table 6) had a value above 0.90 or slightly below, which belongs to acceptable fit values (≥ 0.90).

Table 6. *User model versus baseline model*

Fit index	Value
Comparative Fit Index (CFI)	0.916
Tucker-Lewis Index (TLI)	0.895
Bentler-Bonett Normed Fit Index (NFI)	0.904
Bollen's Relative Fit Index (RFI)	0.881
Bollen's Incremental Fit Index (IFI)	0.917

Source: Authors

The calculated parameter values for the dependent variable Sequential Forward Selection (SFS) are shown in Table 7. The SFS is an iterative method used for feature selection which identifies the most important variables. Four out of the five predictor variables had a statistically significant positive relationship with the dependent variable SFS: the quality of the faculty's teaching staff, the quality

of the faculty's study programs, the faculty's reputation, and the faculty's image. The variable representing the quality of the faculty's non-teaching staff had a negative and statistically insignificant relationship with the dependent variable SFS. The total variance explained in the dependent variable was 82% ($R^2 = 0.82$). The variable faculty's reputation had the highest estimation and beta coefficients, contributing 40% to the relationship with the dependent variable. The variables the quality of the faculty's study programs (20%) and the faculty's image (28.5%) also contributed to defining the relationship with the dependent variable. The variable quality of the faculty's teaching staff had a lower, but statistically significant, beta coefficient, with a 12.3% contribution. The quality of the faculty's non-teaching staff had a negative beta coefficient and did not significantly contribute to the relationship with the dependent variable SFS.

Table 7. *Parameters estimates for relation of Satisfaction variable with five predictors*

Predictors	Estimate	SE	95% CI		β	p
			Lower	Upper		
The quality of the faculty's teaching staff	0.147	0.049	2.983	0.123	< .001	0.147
The quality of the faculty's non-teaching staff	-0.019	0.028	-0.667	-0.017	0.505	-0.019
The quality of the faculty's study programs	0.212	0.045	4.668	0.199	< .001	0.212
The faculty's reputation	0.664	0.102	6.525	0.402	< .001	0.664
The faculty's image	0.276	0.044	6.314	0.285	< .001	0.276

SE – standard error of estimate; 95% CI – 95% confidence interval of estimate; β – standardized regression coefficient; p – statistical significance

Source: Authors

Based on the established logical and discriminant validity, as well as the validity of the measurement concept itself, it can be concluded that the obtained data are suitable for creating a structural model based on a theoretically defined structure and for testing the research questions and hypotheses. All relations and beta coefficients of latent variables and items as well as predictor variables with the dependent variable SFS are shown on Figure 2 as the Path diagram (Miranda, 2025**;** Nazari et al., 2025). The independent variables are well defined with appropriate items with high beta coefficient values, ranging from 0.62 to 0.85. Standardized beta coefficients of 4 independent variables were positive in the range of 0.12 - 0.40, and a negative, almost zero value was obtained for one variable.

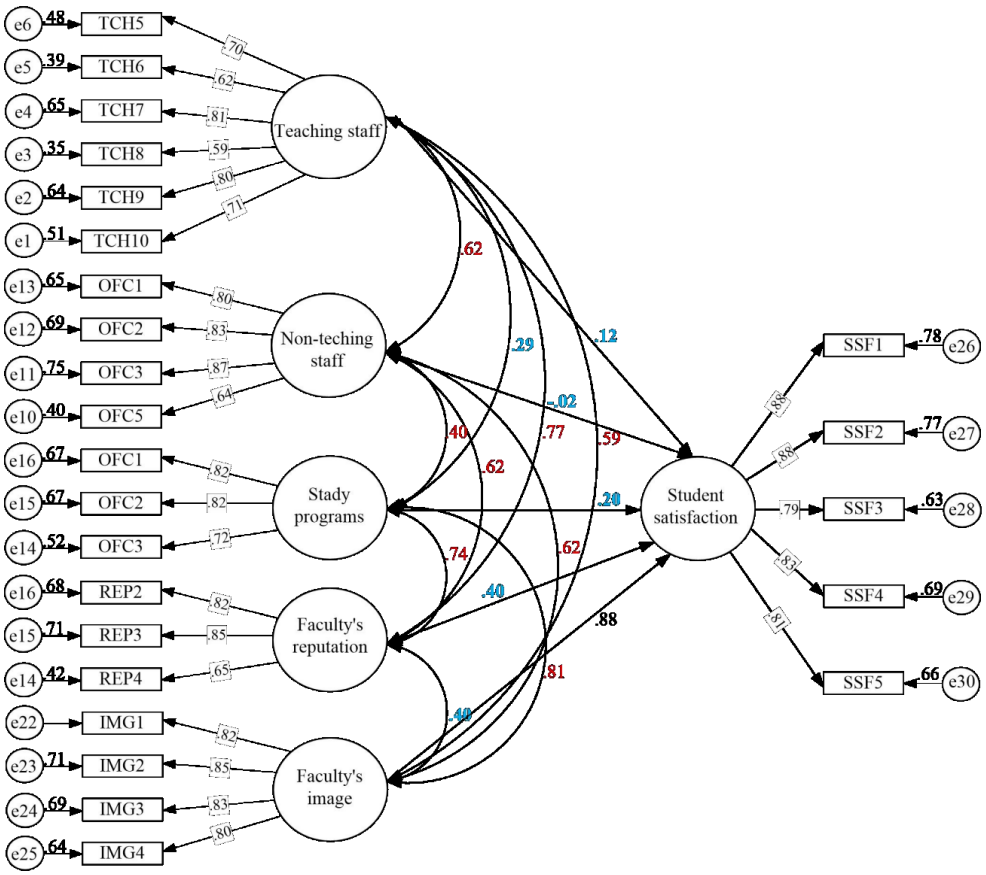

Figure 2. *Path diagram of Satisfaction dependent variable and predictors*

Standardized beta coefficients and squares of multiple correlation of items with independent variables, standardized beta coefficients of dependent variables with independent variables (blue color) and correlations of independent variables (red color) are shown.

4. Discussion

The aim of the research was to model the factors affecting the quality of services, formulated based on a hypothetical factor model for assessing the level of quality of services provided by faculties in the Republic of Serbia and student satisfaction. The created questionnaire was applied to a sample of 1,212 respondents from 13 higher education institutions of public universities in the Republic of Serbia. Considering that the instrument used in the research was not standardized but developed for research purposes, an item analysis of the questionnaire was performed to determine the reliability of respondents' separation of the defined composite variables and the measurement characteristics of the items. Most of the independent composite variables showed satisfactory reliability of respondents' separation and weighting characteristics. Three items (TCR1, TCR3, and OFC3) had Outfit coefficients below the lower limit, and two items (OFC6 and SAS6) were significantly above the upper limit and were therefore removed from further analysis. The resulting hypothetical model, with 25 items, showed good fit characteristics and high internal consistency of latent variables, above 0.80.

High average scale values for all composite variables, i.e., subscales on the questionnaire, showed above average student satisfaction with the quality of services provided by faculties in the Republic of Serbia, which was also obtained in other studies (Bajaj & Arya, 2022; Del Río-Rama et al., 2021; Ngo et al., 2025; Nguyen et al., 2025; Thanh & Nguyen, 2025). This underscores the awareness and responsibility of the management and all employees at faculties in Serbia when it comes to the quality of services at these institutions. The hypothesized model for assessing the perception of the quality of studies with five latent variables: Quality of the faculty's teaching staff, Quality of the faculty's non-teaching staff, Quality of study programs, Faculty's reputation, and Faculty's image, has satisfactory reliability and a significant relationship with student satisfaction. We found a statistically significant relationship between four out of five variables for evaluating the quality of services at faculties and student satisfaction with the quality of services at faculties. Simultaneously, the most important role in defining that relationship was played by the variable Faculty's reputation in the academic community (Rahman et al., 2023). The results showed that the variables Faculty's image and Quality of study programs play a more significant role in defining student satisfaction with the quality of services. The results obtained are in line with the results of earlier research (Bajaj & Arya, 2022; Del Río-Rama et al., 2021; Ngo et al., 2025; Nguyen et al., 2025; Thanh & Nguyen, 2025).

It is essential to acknowledge that prospective students' institutional choices are frequently mediated not only by their academic predilections but also by the perceived reputation and institutional image of the faculty. This perception probably stems from the belief that the faculty, which has been highly rated for years and has excellent results in educational and scientific work, gives an a priori guarantee of service quality. A somewhat unexpected finding is that students do not place the quality of study programs and teaching staff in the most important place when evaluating their satisfaction with faculty services. The present research did not establish a significant relationship between the quality of student services and non-teaching staff with student satisfaction. Students' contacts with faculty services are of a technical nature and are generally not frequent and burdened with special requirements. Therefore, it is understandable that students do not perceive these services as significant for determining the level of satisfaction with the quality of the faculty's services.

Bearing the results of the research in mind, we can conclude that the general hypothesis can be accepted and that the questionnaire with five applied factors statistically significantly defines the students' perception of the quality of services of public faculties in Serbia and their satisfaction with the services provided. Following the acceptance of the general hypothesis and research results:

- Hypothesis H1 is accepted: The competence of the teaching staff has a statistically significant and positive effect on the opinions of students about the quality of the faculty's services and satisfaction with studies.
- Hypothesis H2 is not accepted: The quality of services provided by non-teaching staff does not have a statistically significant influence on students' opinions about the quality of faculty services and satisfaction with studies.
- Hypothesis H3 is accepted: The quality of the study program has a statistically significant and positive effect on students' opinions about the quality of faculty services and satisfaction with studies.
- Hypothesis H4 is accepted: Faculty's reputation statistically significantly and positively influences students' opinion on the quality of faculty services and satisfaction with studies.
- Hypothesis H5 is accepted: The faculty's image has a statistically significant and positive impact on students' opinion about the quality of the faculty's services and satisfaction with studies.

5. Conlusion

The results of the conducted research refer to the possibility of comparing the concept obtained as a result of the observed and processed data with the concept that exists in universities in the country. Judging by the results of the current research, higher education institutions that want to improve the quality of their services can use appropriate measuring instruments to check the key points where student satisfaction appears. Based on this, the management of the higher education institution is given the opportunity to effectively plan the next steps with the aim of directing activities toward the main factors of student satisfaction.

The applied questionnaire showed good measurement characteristics and, with the described item reduction, can be used for a valid assessment of the perception of the quality of services of higher education institutions in Serbia. Although the factor that includes items related to professional services and non-teaching staff of the faculty did not show a significant relationship with student satisfaction, it has significant relationships with other hypothetical factors. Thus, the set of items covering this segment of services should be modified and harmonized for the assessment of student satisfaction and preserved in the questionnaire.

In summary, this study validates the tool used to measure service quality in Serbian higher education institutions. While the earlier research by Dunić et al. (2025) highlighted the strong predictive ability of the five-factor model through machine learning methods, this current study reinforces the model's structural soundness and internal consistency using Rasch and SEM analyses. Together, these two studies provide a thorough evaluation: one focusing on prediction and the other on measurement. The results indicate that, with some minor adjustments to the item structure, the questionnaire can be a dependable and valid resource for both research and practical applications in the field of higher education quality management.

Although the research findings provide valuable insight into perceptions of service quality in higher education institutions, the limitations relate to the application of the questionnaire to a sample that does not encompass all types and regions of higher education institutions in Serbia, as well as the exclusive reliance on students' self-reported assessments. Future research should focus on further validation and refinement of the instrument, the inclusion of additional stakeholders in the educational process, and the adoption of a longitudinal approach to monitor changes in satisfaction and service quality over time.

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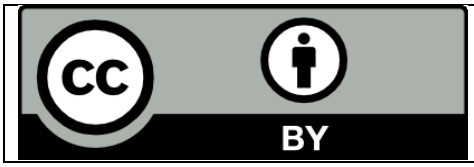

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