

## **International education investigation and evaluation in Nanjing, China**

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### **Abstract**

In recent years, China has become one of the major hubs for international education. To attract more students, Chinese universities should consider the satisfaction of international students as it relates to the university rankings. This paper attempts to contrast Chinese universities in Nanjing against international institutions using Analytical Hierarchy Processing (AHP), a decision-making tool, based on satisfaction index factors. Previous research suggested 11 major satisfaction factors that were contracted to 5 for study purposes. However, collected data suggested a more robust model with 3 main satisfaction predictors such as “Teaching and Curriculum”, “Dormitory Conditions”, and “Canteen Catering”. International students perceive “Teaching and curriculum” as the most important in deciding the best university. However, AHP yielded ambiguous output. Technique of order preference similarity to the ideal solution (TOPSIS) was applied to determine the best university. Nanjing universities outperformed international peers with the score of 0.552.

**Keywords:** International education, university satisfaction, satisfaction measurement, AHP, Multiple regression model, TOPSIS.

## 1.1 Introduction

In recent years, the Chinese government has made numerous efforts in increasing the number of students coming from abroad. Since its entrance into the World Trade Organization in 2002, China has promoted Chinese culture and language with the establishment of Confucius institutes across the globe, succeeding in the country's international affairs. Starting with 7259 foreign students from 68 countries in the period 1950-1966, China was able to grow this number to nearly 223 500 since the Olympic games in 2008 (Wen, 2012). Regarding countries where foreigners came from, China hosted around 80 000 students from Korea and Japan, 30 000 from Europe, 20 000 from ASEAN countries, and 15 000 from the United States (Wen, 2012). According to the ministry of education of the People's Republic of China (MOEPRC), international students totaled 492,185 in 2018, who attended 1,004 higher education institutions ("Statistical report on international students in China for 2018", 2019). Compared against the same statistics from 2012, a 51% leap in the number of foreign students constitutes the fruits of the program. This tendency and potential in hosting more international students make China a lucrative research focus in the area of international education.

As per reputed university ranking QS ("Top Universities", n.d.), 20, 11, and 15 out of the top 100 universities in China are based in Beijing, Shanghai, and Jiangsu Province respectively. The dominance of Jiangsu universities over Shanghai universities highlights an urge to look more thoroughly at the former host. In addition to the international ranking, a general number of internationally-recognized education institutions in the observed locations follow the trend. The numbers are 59 for Beijing, 34 for Shanghai, and 50 for Jiangsu Province. Taking into account this phenomenon, Jiangsu Province should be analyzed separately.

## 1.2 International education in Jiangsu Province

Analyzing rankings of universities in Jiangsu Province, 23 out 50 well-recognized universities are situated in Nanjing, the capital of the province. Other major educational hubs like Changzhou, Xuzhou, and Yangcheng account for half of the number Nanjing has. Moreover, the composition of the top 15 Jiangsu institutions listed in the top 100 in China reinforces the prevalence of Nanjing universities. According to QS ranking ("Top Universities", n.d.), 10 out of 15 top-tier educational hosts are in Nanjing, which accounts for 62%.

Having established the dominance of Nanjing universities in Jiangsu Province, it is worthwhile to concentrate and rely mostly on the Jiangsu capital as the true representative of the third-largest host for international students in China.

At a closer look, six Nanjing universities namely, Nanjing University, Southeast University, Nanjing university of science and technology (NUST), Nanjing normal university (NNU), Nanjing University of aeronautics and astronautics (NUAA), and Hohai university constitutes 70% of the students. Besides, they have admitted more than 600 international students each. Similar statistics in other universities fail to accept as many foreigners. Table 2 provides data on the number of enrolled regular and international students in the listed universities.

Table 2 - Largest Nanjing universities

University	Number of students	Number of international students
Nanjing university	33,115	3,000
Southeast university	32,924	2,039
NUST	27,601	935
NNU	27,620	1,587
NUAA	29,746	999
Hohai university	33,304	694

### 1.3 Significance of the research

Under the huge influence of the “One Belt, One Road” initiative, international education in China has become a very important field of research for ensuring the quality of the education received, creating a good image of China in the minds of foreign students, and improving global rankings of Chinese universities. Currently, available research highlights underlying reasons why students come to China and select particular universities. Furthermore, collected evidence also contains measured satisfaction levels with Chinese universities in certain provinces.

Although the research has been already conducted in the mentioned area, it is still minuscule and requires more case studies and replications in other areas. Along with research on satisfaction of studying in Chinese universities among foreigners, there is insufficient data on international comparisons of Chinese universities with international peers.

Using modern methods and techniques of management and decision-making, Analytical Hierarchy Processing (AHP), and regression analysis, the paper will attempt to reassure the available satisfaction model and use its factors to contrast international higher institutions with the ones in Nanjing. It can capture exactly where and why Nanjing universities perform superior or inferior to international peers. Therefore, the paper will suggest practical recommendations on how to boost international students’ satisfaction and thereby enhance the performance of Nanjing universities in general.

## 2. Literature review

### 2.1 Stakeholder approach

Previous research suggests that universities as economic organizations have their stakeholders who are affected by business processes. One of the major stakeholders deemed to be students as per the university's origins. McClung and Werner discuss the concept of value that universities propose to students, alumni and parents and signify the importance of the image and reputation of educational entities (2008). Being among competitors on the market for students underlines how crucial the value proposition becomes. Thus, scholars state that universities' management should focus on the value delivered as a key performance indicator, which can be measured by students' satisfaction (2008). In turn, satisfaction appears to accurately reflect a university's efforts in terms of quality of education, service, facilities, and other benefits that a student experiences (Mainardes, Alves, & Raposo, 2013). In addition, universities shall be economically concerned with their country-level and global ranking for leveraging its image as the vital driver of value. It is denoted as a function of research output, reputation, and internationalization ("Understanding the Methodology: QS World University Rankings", 2016). The last two comprise 50% of ranking determination. Moreover, scholars found that reputation is positively influenced by internationalization (Delgado-Marquez, Escudero-Torres, & Hurtado-Torres, 2013; Sanders, 2018) which greatly emphasizes the link between the number of international students and university ranking. Ultimately, it establishes that reputation and ranking are recursive and increase with more international students enrolled and other benefits, which students seize. Indeed, the quality of education is perceived through reputation and ranking by international students in China (Jiani, 2016).

Before delving into student satisfaction analysis, one needs to understand how services such as education are evaluated. Ann McGill and Dawn Iacobucci studied the importance of pre-and post-experience factors on unfamiliar service assessment (1991). The scholars explained that people who are less familiar with the service outcomes had post-experience factors as the basis of their evaluation, while subjects with clear expectations relied on pre-experience factors. Furthermore, the former ones tend to focus their evaluations more on interpersonal features, small details, and a greater number of attributes compared to the latter ones. Therefore, segmentation of the students is required to craft robust models in satisfaction measurement.

### 2.2 Pre-experience factors

These parameters are usually expressed in the forms of motivations and reasons why students choose a particular country and university to study. To fully capture why China has been chosen over other education hosts, one can refer to exploratory studies. Noteworthy to mention that major reasons for coming to China appear to be the cost of education (low tuition and availability of scholarships) along with the country's lucrative culture (Jaini, 2016; Liu, 2018; Ahmad & Shah, 2018). Other factors include geographical proximity for students from neighboring countries (Liu, 2018), future economic prospects of the host (Jiani, 2016), and reputation of Chinese universities (Ahmad & Shah, 2018).

Discussing the university selection, Jiani underlines that only students from Asian countries regarded university reputation and ranking as criteria for selection; while students from western countries cited inter-institutional agreements as the main reason (2016). To add, Ahmad and Shah investigated that the quality of academic staff and learning environment were valued the most important in university selection (2018). Liu, Kamnuansilpa, and Hirofumi noted the quality of education as an important factor (2018).

## **2.3 Post-experience factors**

### **2.3.1 Satisfaction factors in foreign countries**

Australian researchers performed time series analysis of numerous university aspects on gauging students' satisfaction. Data are collected through the means of 5 point Likert scales that ask the extent to which an aspect is important and how satisfied students are with the aspect. The results showed that across 7 years students valued the ease of access to the library, online learning facilities, clear and easily accessible information about exams and exam timetables, off-campus access to library e-resources, ease of access to computers (Grebennikov & Shah, 2013), all of which referred to educational facilities. Furthermore, the administration was advised as an improvement area for overall satisfaction. Course-related aspects were of high importance and performance.

In another study, social conditions, professional advancement, the pragmatism of knowledge, educational facilities, courses offered, and faculty's achievements were found to be statistically significant in determining satisfaction with social conditions being the most important among Polish students (Sojkin, Bartkowiak, & Skuza, 2011). Social conditions included university facilities for sport, leisure, and entertainment. Controlling for age and gender, scholars established small differences in that female and older students were more concerned with social conditions. The latter ones valued professional advancement more than younger students.

Mainardes, Alves, & Raposo applied multiple regression analysis on the data collected from Portuguese students. Researchers proposed a model of 12 variables with an explanatory power of 52.3% (2013). The model signifies that the university's environment is the first most important factor and university adaptability to students' needs is the second.

### **2.3.2 Satisfaction factors in China**

Similar studies have been conducted in China to explore the nature and underlying principles of student satisfaction. According to Wen, Hu, and Hao, international students' satisfaction of studying in eight top universities in China is usually attributed to learning satisfaction with key factors namely, faculty-student interaction (2018). The factor comprises student communication with professors and faculty members as well as social interactions with peers. Both influenced satisfaction. This study also underscores that language of instruction creates a discrepancy in satisfaction between students. Those who have been taught in Chinese reported higher satisfaction scores.

Research conducted with international students at Shanghai university exhibits akin pattern. Being taught the Chinese language, students had higher satisfaction scores than students in the main subject classes (Ding, 2016). Besides, satisfaction of the main study was reported to be lower than in other countries. Satisfaction of the university administration services was quite low too.

A more comprehensive approach to measuring international student satisfaction in China was exploited by Li, Zhu, Thige, and Shi. The scholars created a model with 11 independent variables which explained 98% of satisfaction variation among students (Li et al., 2017). The data were taken from 44 universities in Jiangsu Province. The model contained curriculum, teacher, school system, teaching facilities, library, website construction under school learning; while hostel accommodation, canteen catering, entertainment, and sports activities, student affairs and services, other school facilities, and services were classified as school life parameters.

Expanding towards a generalized picture of student satisfaction in China, one can examine inter-institutional comparisons analyzed by Zhang, Foskett, Wang, and Qu. They investigated that teaching-related factors such as poor academic standard of teachers, outdated content, and lack of

teaching experience were the most influential in whether a student was satisfied with a university (Zhang et al., 2011). However, students reported poor campus “climate and culture” to be the major reason for not selecting a particular university again. The paper also signifies other institutions’ superiority in higher student satisfaction to research-oriented education entities.

## **2.4 Indirect comparison of Chinese universities to International peers**

According to the exploratory study conducted by Bian Cui, international students in Chinese and French universities were contacted to learn more about their experience in the host universities. The paper provides that Chinese universities appear to have superior campus facilities and financial support to French universities (Bian, 2013). On the contrary, the latter excelled at class procedures and learning environment, and students in the former university reported to be “passive learners”.

## **2.5 Theoretical background**

### **2.5.1 Analytical hierarchical procedure (AHP)**

AHP refers to an analytical hierarchical procedure that is widely spread and used as a decision-making tool. Created and further developed by Saaty (1970), AHP incorporates pairwise comparisons of alternatives against a set of criteria of evaluation. Comparisons are subjective and presented as scores that reflect inaccurate comparative discrepancies rather than absolute magnitude. Therefore, later procedures are required to check for respondents’ consistency in his or her answers. Once, consistency is established analysis can be performed. First, scores of all respondents have to be aggregated and then, one has to determine the weights for the criteria to understand their importance in decision making. Subsequently, implications of the analysis highlight optimal alternatives under the criteria and consolidated opinions.

### **2.5.2 Technique of order preference similarity to the ideal solution (TOPSIS)**

TOPSIS is a multiple-criteria decision-making tool that employs creating two hypothetical alternatives from the observed data (Hwang & Yoon, 1981). One incorporates all high scores possible under the name of “positive ideal solution”. The other option encompasses all low scores under “negative ideal solution”. After having crafted positive and negative solutions, the distances between hypothetical and actual alternatives are calculated. The closer to positive and farther from negative an option is, the more optimal this solution becomes. Positive and negative ideal solutions are constructed based on the scores of available alternatives. Then, distances are measured to determine the best alternative.

### **2.5.3 AHP and TOPSIS**

It is a widespread practice to combine multi-criteria decision-making techniques such as AHP and TOPSIS to balance weaknesses to clarify linguistic ambiguity. For instance, Singaravel and Selvaraj collected evidence for the effectiveness of this combination in optimizing machine selection (2015). Another research was conducted in an attempt to apply the method for deciding on the best weapon selection for defense system purposes (Dağdeviren, Yavuz, & Kılınç, 2009). Regarding customer-related cases, scholars Lin, Wang, Chen, and Chang employed a synthesis of AHP and TOPSIS to assist product-designers in obtaining valuable customer preferences and judgments on design attributes (2008).

### **3. Method**

As Nanjing universities are contrasted with international peers, foreign students of Nanjing universities were taken into consideration. Participants were approached online at convenience. Yet, the sample was controlled to capture the variety of educational entities in the studied area. The study's participants were administered with a two-step study design.

#### **3.1 Online Questionnaire**

The first part is an online survey, which consists of demographic questions on respondents' e-mails for further contact, gender, country of origin, previous place of study, current university, and level of study such as bachelor, master, Ph.D., or other. Questions on students' satisfaction followed after. Previous research incorporates 11 factors in measuring satisfaction of studying in Chinese universities. Taken into account the low expected response rate, 11 factors were contracted to 5 major ones. They included teaching and curriculum, teaching facilities (classrooms and labs) and library, dormitory conditions, canteen catering, and student affairs, and other services. According to the available research, these factors account for the most variation in students' satisfaction. The sixth question asked for overall satisfaction of studying in Nanjing universities.

#### **3.2 Observed five factors**

"Teaching" stands for teaching methods, teachers' knowledge, and teacher-student communication. "Curriculum" stands for courses one needs to take to complete one's study and includes electives if any, choice of textbooks, and other content. "Teaching facilities" implies classroom and lab conditions and how equipped they are. "Dormitory conditions" means the conditions of on-campus accommodation. "Canteen catering" - variety and quality of food offered on campus. "Student affairs and other services" stands for student assistance and guidance, life advice and help, activities to promote understanding of Chinese culture, and other school life-related services.

Questions were designed as unbalanced 6-point Likert type scales with numbers from 1 to 6, denoting "Very Dissatisfied", "Dissatisfied", "Slightly dissatisfied", "Slightly satisfied", "Satisfied", and "Very satisfied" respectively. This scale was deliberately made unbalanced to avoid expected neutrality in judgments. All the sections of the satisfaction measure were accompanied by a brief description of what factors imply.

#### **3.3 AHP Operating system**

Only those students who studied both abroad and in China were eligible for the second part. After screening, the remaining participants were asked to provide their judgments on AHP hierarchy via the "Implementation of an Online Software Tool for the Analytic Hierarchy Process (AHP-OS)" platform (Goepel, 2018). AHP hierarchy comprised 5 criteria and 3 alternatives. For the criteria, 5 aforementioned satisfaction factors were taken. For alternatives, respective universities in Nanjing, university abroad, and the artificial option of "University C" were presented. This third option was given to have an objective benchmark in comparisons. The description of the given university was constant across respondents.

### **4. Results**

#### **4.1 Descriptive statistics**

Only 38 participants completed the online questionnaire. Among them, there was an equal distribution between male and female respondents. Due to the convenience sampling technique,

students from Russian speaking countries prevailed. The number totaled 13, among which 7 represented Kazakhstan, 4 came from Russia and the other 2 were noted to be Ukrainian and Belarus. The rest of the participants represented various countries as follows: 4 from Ghana, 3 from Pakistan, 2 from Nepal, 2 from Egypt, 2 from Ethiopia, 2 from Rwanda, and 1 per each of the following 10 countries (Algerie, Congo, Hungary, Indonesia, Thailand, Togo, Turkey, Vietnam, Kenya, Morocco).

The target of the study was to question students of a master's degree level and above. Out of 38 participants, 26 pursued a master's degree, 4 pursued bachelor's degree, 3 pursued Ph.D. Each of the other 5 participants noted either "Exchange Program", "Language Courses", "Employment, Associate Professor", "Graduation" or "Not studying" as the current program in China.

With regards to universities in Nanjing, participants mentioned Nanjing University of Aeronautics and Astronautics (26 students), Nanjing University of Science and Technology (3 students), Nanjing University of Finance and Economics (2 students), Nanjing University (1 student), Hohai University (1 student), Nanjing Tech University (1 student), Nanjing Normal University (1 student), China Pharmaceutical University (1 student), Nanjing University of Information Science and Technology (1 student). There was one student not being enrolled at any university at the moment.

In terms of satisfaction levels, data demonstrated that the majority of students has positive experience with 5 observed factors and Nanjing universities overall. It is noteworthy that ranking factors based on strong satisfaction (either very satisfied or satisfied) reveals how a Nanjing university is perceived from each side. The rank goes as given below:

Canteen Catering (Either very satisfied or satisfied) - 78.9%

Teaching facilities and library (Either very satisfied or satisfied) - 76.3%

Teaching and Curriculum (Either very satisfied or satisfied) - 60.5%

Student affairs and other services (Either very satisfied or satisfied) - 50%

Dormitory conditions (Either very satisfied or satisfied) - 42.1%

Satisfaction of studying in a Nanjing university (Either very satisfied or satisfied) - 57.9%

Applying needed screening before AHP analysis, only 14 respondents were contacted to share judgments on alternatives.

## 4.2 Multiple regression model

### 4.2.1 5-factor model results

A model with 5 factors showed relatively promising performance on statistical significance and explanation power. Figure 1 illustrates the output (See Appendix). Quite high adjusted r-squared highlights substantial goodness of fit to the data. F-statistic, being greater than 10 in this case, points to statistical significance, especially with p-value being close to zero. Yet, dissecting individual statistics of the factors brings deeper insight into the data. The figure also depicts that factors like "Teaching facilities" and "Student affairs and other services" are not statistically significant having a p-value greater than 0.05. The result suggests considering a 3-factor model, which should yield a superior outcome.

### 4.2.2 3-factor model

After removing statistically insignificant predictors from the model, a more robust version outperformed the 5-factor model. Adjusted r-squared stayed almost the same at the point of 0.70. However, F-statistic grew dramatically to 29.94. The previous model showed only 19.39. Figure 2 depicts the output of the multiple regression analysis with 3 factors (See Appendix). This finding



implies that the second part of the study of the AHP model shall possess three main criteria, which are “Teaching and Curriculum”, “Dormitory Conditions”, and “Canteen Catering”.

### 4.3 AHP analysis

After establishing the number of criteria for further analysis, an AHP procedure was conducted to evaluate participant’s judgment on Nanjing and foreign universities. Calculating individual weights for three criteria, students rank factors on their importance in the following order: teaching and curriculum, dormitory conditions, and canteen catering. Associated weights are 0.46, 0.334, and 0.206 respectively. Moreover, other crucial parameters of AHP analysis at this stage show a low group consensus of 58.3%. Consolidated consistency ratio (CR) equals 0.1%.

Expectedly, group consensus for alternative assessment was even lower. It resulted in 44.5%. Students chose Nanjing universities as preferred ones yet, the difference between options was minuscule. The calculations are 34.6%, 34.1%, and 31.3% for Nanjing universities, universities abroad, and “University C” respectively.

Dissecting the breakdown by criteria, greater insight can be witnessed. The lowest group consensus appeared under “Canteen catering”. CR for it is 1.4%. For “teaching and curriculum” and “dormitory conditions”, consensus ratios are 0.7% and 0.1% respectively.

The priorities for each of the studied criteria are given in Table 3. According to the breakdown, universities abroad outperformed universities in Nanjing under “Teaching and Curriculum”. In addition, artificial constant in the study, “University C”, was perceived superior to Nanjing universities under the main criterion. For the remaining two factors, preferences were the opposite. Nanjing universities were preferred to the other two studied alternatives.

Table 3 - AHP output breakdown by criteria

Criteria	Alternative	Priority	Rank
Teaching and Curriculum	Nanjing university	29.4%	2
	University abroad	41.9%	1
	University C	28.7%	3
Dormitory conditions	Nanjing university	38.5%	1
	University abroad	29.1%	3
	University C	32.4%	2
Canteen catering	Nanjing university	40.0%	1
	University abroad	24.9%	3
	University C	35.1%	2

#### 4.4 TOPSIS analysis

Although Nanjing universities slightly outperformed international peers, the vagueness of the outcome caused by low consensus does not exhibit distinct superiority. To highlight required distinction, the Technique of Order Preference Similarity to the Ideal Solution (TOPSIS) is used. This method requires similarly structured data as in AHP for its input. After specifying three criteria and three alternatives, consolidated weights and decision matrix were taken from the AHP result.

The output of TOPSIS signifies that participants favored Nanjing universities as they resemble the ideal solution the most. With a score of 55.2%, Nanjing universities top the comparison of three university types. Foreign universities and study constant, "University C", had 48.5% and 44.8% respectively. Application of TOPSIS was able to remove ambiguity in the data and establish the preference of Nanjing universities among participants.

#### 5. Discussion

Interpreting the output of both AHP and TOPSIS, Nanjing universities are perceived as superior to international peers and artificial benchmarks. However, small priority differences between alternatives imply an underlying contradiction. To establish the origin of discrepancies, this study analyzed the breakdown by each criterion.

According to this breakdown, students generally agree on ranking Nanjing universities higher under "Dormitory conditions" and "Canteen catering". Nevertheless, these factors are less important to students in evaluating universities than "Teaching and curriculum". It possesses the greatest importance weight, making a perception of the given criterion more significant. Therefore, analysis of the most important criterion underlines that Nanjing universities are perceived to perform poorly. It is noteworthy that international students place the university that they previously studied in the highest.

Retrieving the definition of "Teaching and curriculum" given in the study, one can rationalize the poor performance of Nanjing universities under this criterion.

One of the potential reasons for it can lie in teacher-student communication. Numerous professors in Nanjing universities lack sufficient English proficiency to provide high-quality assistance or material explanation. Professors and international students may miscommunicate and thus, students' satisfaction may decrease. On the contrary, foreign universities have taught students either in English or in students' native language which makes communication easier and richer. As a result, students receive more assistance throughout the course than they may receive in Nanjing universities.

Another reason one can infer from the output and criteria definition is course and study requirements students need to meet. Due to loose pressure and low requirements for a student to pass a course or graduate, "Teaching and curriculum" may be perceived as underperforming. Compared against participants' current universities, foreign universities could have had stricter study demands because of the reason above: professors provide more knowledge and expect great efforts in return.

Apart from language-centric reasons for this phenomenon, a simple transition from bachelor's to master's degree programs could shape such a poor perception on "Teaching and curriculum". Generally, bachelor's degree students experience pressure and must meet tougher requirements to graduate than the ones master's level students undergo. This idea is greatly supported by the number of classes and time spent on studying. Bachelor's degree students tend to have more classes, thereby utilizing more time on their studies rather than on other activities. Due to the study design and its sample, master's level students could subconsciously compare programs

rather than universities. Students could attribute engagement from the studies to the program type rather than the actual university.

## **6. Limitations and prospects**

The major limitations of the study were a low response rate and a small number of participants due to method selection in a pandemic period. First, bigger data can capture other trends and yield different outputs. Probably, more responses can increase consensus in students' judgments and thus, reflect more accurate students' perceptions of Nanjing universities' performance. Not only do bigger data change the result of the AHP model but also it could suggest a brand new model for the multiple regression analysis. It impacts the outcome as application of multiple regression analysis proposed and reaffirmed the criteria selection. Second, selecting an online method to reach international students in Nanjing was not the optimal solution. Due to the vast number of questions study participants need to undergo, the online version of the study had to be contracted to improve the expected response rate. Consequently, the number of criteria in the questionnaire was chosen to be concise rather than the one in the available research, which had greater explanatory power. Third, encompassing other degree type students could segregate perception of a university from the perception of a study program. This will assist in refining findings and their applications.

Future studies can focus on replicating this research and avoid the limitations described above. Having mitigated method limitations, one can include more criteria and suggest other factors that would stress the differences between alternatives in a more meaningful way. In addition, this research should be replicated in other Chinese cities to construct a general understanding of Chinese universities' performance contrasted with international peers.

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## Appendix

Figure 1 - 5-factor model regression output

Predictor	Coefficient	Estimate	Standard Error	t-statistic	p-value
Constant	$\beta_0$	-1.0457	0.6283	-1.6644	0.1058
teaching and curriculum	$\beta_1$	0.2993	0.1335	2.2418	0.032
teaching facilities (classrooms and labs) and library	$\beta_2$	0.0659	0.1265	0.5212	0.6058
dormitory conditions	$\beta_3$	0.261	0.0675	3.865	0.0005
Canteen catering	$\beta_4$	0.2905	0.11	2.6412	0.0127
Student affairs and other services	$\beta_5$	0.1667	0.0932	1.7884	0.0832

### Summary of Overall Fit

R-Squared:	$r^2 = 0.7518$
Adjusted R-Squared:	$r^2_{adj} = 0.7131$
Residual Standard Error:	0.52 on 32 degrees of freedom.
Overall F-statistic:	19.3896 on 5 and 32 degrees of freedom.
Overall p-value:	0

### Analysis of Variance Table

Source	df	SS	MS	F-statistic	p-value
Regression	5	26.2154	5.2431	19.3896	0
Residual Error	32	8.653	0.2704		
Total	37	34.8684	0.9424		

Figure 2 - 3-factor model regression output

Predictor	Coefficient	Estimate	Standard Error	t-statistic	p-value
Constant	$\beta_0$	-0.7661	0.5627	-1.3615	0.1823
teaching and curriculum	$\beta_1$	0.4507	0.1073	4.2024	0.0002
dormitory conditions	$\beta_2$	0.2692	0.0656	4.1014	0.0002
Canteen catering	$\beta_3$	0.3002	0.1049	2.8629	0.0071

### Summary of Overall Fit

R-Squared:	$r^2 = 0.7255$
Adjusted R-Squared:	$r^2_{adj} = 0.7012$
Residual Standard Error:	0.5306 on 34 degrees of freedom.
Overall F-statistic:	29.9491 on 3 and 34 degrees of freedom.
Overall p-value:	0

### Analysis of Variance Table

Source	df	SS	MS	F-statistic	p-value
Regression	3	25.2959	8.432	29.9491	0
Residual Error	34	9.5725	0.2815		
Total	37	34.8684	0.9424		