Factors of Computer Laboratory Service Choosing: Case Study Faculty of Science Chandrakasem Rajabhat University

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Abstract— This research is proposed to formulate the factors that affect to the selection of computer laboratory services. The studying results can be seen as a guideline for the service improvement of computer laboratory services at the Faculty of Science, Chandrakasem Rajabhat University. The satisfactory score was collected from 173 students, junior and senior information technology and computer science student, who access the resource from the laboratory (as samples). Within the questionnaires, a student must rank the importance of these factors. The analysis is done by Conjoint Analysis. The results show that the most important factors are "Computer High specification", "Variety Microsoft office Applications" and "Internet WIFI Connection". The total utility factor is about 1.099.

Keywords - Computer lab services satisfactory factors, Conjoint analysis.

I. INTRODUCTION

Computer service laboratory provide resource of knowledge, developing programming, internet, software, e.g., compilers, administration software, etc. If the laboratory services have enough resources for all student needs, it will be benefit for student to develop their information technology skill. They can use their knowledge efficiently and learn more experience in their work.

The objective of this research is to find important factors that affect learning skills determined by computer science students. So, these factors can give insight for department staff to plan learning supports for improving students skill in the future.

II. LITERATURE REVIEWS

A. Theory

1) Dummy variable [1]

Dummy variable is a variable which represent two status: 0 or 1. They are widely used for representing "none" or "there are". Dummy variable is used to transform qualitative variable to quantitative variable. In some applications, they can be used in statistical analysis such as linear regression, and time series analysis. For example, the qualitative variables in salary problem are gender, religion, region and category. When dummy variable appears in the predicting equation, it will not directly affect dependent variable value increasing. For instance, the linear regression equation for dependent variable of income-salary is depended on education (years of learning) and gender (male or female). Gender is a category variable affecting salary as shown in equation (1).

$$Salary = \alpha_0 + \delta_1.gender + \alpha_1.education \quad (1)$$

We can use subscript "0" for male and "1" for female. From equation (1), female salary is depended on δ_1, whereas male salary is not.

If there are more than one category, the last variable can be set as "-1" so the summation of all variable subscript is zero. For example, the representation of dummy variables for three types of color: Red, Green, and Blue as shown in Table 1.

Table 1 Parameters for dummy variables in case of more than two levels.

	Dummy variables	
Color	**var-1**	**var-2**
Red	1	0
Green	0	1
Blue	-1	-1

II) Conjoint analysis [2].

Conjoint analysis is widely used in linear regression or variance analysis to find the utility of dependent variables (sometimes called Stimuli or Preference). From questionnaire data, there are questions about which attribute that provides the most satisfaction from other attributes. If there are similar products, there will be questions about which product has the most total utility and part worth utility. Part worth utility can be quantitative or qualitative variable. For qualitative variable, they must be changed to quantitative variable before performing analysis. The qualitative variable must be changed into dummy variable using Logit if there are two values. After changing by this technique, we can then perform the linear regression analysis.

Steps for conjoint analysis

a) Assign attribute for qualitative variables.
b) Design questionnaire and collect data
c) Prepare data and set dummy variables (if any)

d) Determine unstandardized coefficients or standardized coefficients using linear regression analysis for all level of each attribute, $\beta_{j,m}$ whereas the values of qualitative variables are $X_{j,m}$

e) Find the utility value y_k from all attributes using the following equation:

$$y_k = \mu + \sum_{j=1}^{J}\sum_{m=1}^{M}\beta_{j,m}X_{j,m}, \qquad (2)$$

where μ is constant, index j is factor or attribute and index m represent category number of each attribute.
Note that all of independent variables in equation (2) are assumed to be qualitative variables. If there are more quantitative variables, then the variables can be added into the equation without changing the dummy variables.

f) Finally, the effectiveness $\hat{\beta}_{j,m}$ of each attribute can be determined by the calculation of unstandardized coefficients or standardized coefficients from attributes using equation (3)

$$\hat{\beta}_{j,m} = \frac{\beta_{j,m}}{\sum_{j=1}^{J}\max_m\left[\beta_{j,m}\right]} \qquad (3)$$

B. Related research

I) Inflibnet-Shodhganga [3]

This research proposes the decision making of server cluster for choosing appropriate computer. The server cluster has different factors as shown in Table 2

Table 2 Utilities and level of utilities

Factor	Server#1	Server#2
OS (X_1)	Window	Linux
LC_Load capacity (X_2)	8 users	6 users
MEM-Memory size (X_3)	4GB	8GB

From Table 2, there are 8 profiles (for example, W-8-4, W-8-8, W-6-4, W-6-8, L-8-4, L-8-8, L-6-4, L-6-8). Clients can choose the most satisfied profile. Linear regression equation can be expressed in terms of

$$y = \mu + \beta_{os}X_1 + \beta_{lc}X_2 + \beta_{mem}X_3, \qquad (4)$$

where X_1, X_2, X_3 are dummy variables composing of operating system (2 levels), load capacity (2 levels) and memory size (2 levels). From conjoint analysis, clients have satisfaction in utility X_2 (57%), X_3 (29%) and X_1 (14%). This can be interpreted that clients prefer the server which has potential to respond to multitasking that can reduce processing time.

II) Andrus Kotr [4]

This research proposes the method to select printer. There are 6 utilities with 3-4 levels and 4 utilities with 2 levels. Total profiles are 324 profiles. For easy calculation, it can be reduced to 18 profiles which are quality of material (3 level), delivery time (3 level), quality of printing (3 level), price (3 level), sale proficiency (2 level) and production flexibility (2 level).

The satisfaction results can be summarized and ranged from quality of material (23.9%), quality of printing (20.9%), delivery time (19.0%), duality of printing (12.9%), sale proficiency (12.3%) and production flexibility (11.0%).

III) Marut Attachot [5]

This research study the factors that affects satisfaction of using computer laboratory at Muban Chom Bueng Rajabhat University students. It is found that the important factors are learning information, learning media, effective computers, using computer in class, programming, using high performance computer for scanning, preparing document, and finally entertainment for communication.

IV) Benya Sansut [6]

This study shows the satisfaction of users from computer laboratory service at Ratchatthani University. It is found that the most satisfactions are the speed of computer, the stability of internet, software, and lastly the amount of provided computers.

V) Information Technology Center, National Institute of Development Administration [7]

This research shows the satisfaction of users in 2016, they show that students prefer the amount of provided computers and the performance of computers. They also comments that more statistical software package should be installed.

From all of the above reviewed researches, important factors are services of computer, internet communication and software.

III. METHODOLOGY

A. Collective factor/attribute and level

This research is aimed to find the factor and the level that affect service choosing. The experiments are performed at the department computer laboratory, Faculty of Science, Chandrakasem Rajabhat University. Sample data are collected from computer science and information technology students in the 3rd and the 4th years since they have many laboratory activities related to computer services. Table 3 shows all of attribute utilities and levels.

Table 3 Utility and level of computer laboratory

Attribute	Level		
Computer	High specification: HS	Medium specification: MS	
Software	Compiler: CO	Office: OF	Calculation: CA
Network	LAN: LA	WIFI: WF	

From Table 3, there are totally 12 profiles in these observations as follows:

1. HS-CO-LA 2. HS-CO-WF 3. HS-OF-LA
4. HS-OF-WF 5. HS-CA-LA 6. HS-CA-WF
7. MS-CO-LA 8. MS-CO-WF 9. MS-OF-LA
10. MS-OF-WF 11. MS-CA-LA 12. MS-CA-WF

B. Dummy variable

From the specified utilities, the dummy variables can be set as shown in Table 4.

Table 4 Dummy variable for each level

Attribute	**Dummy variable**			
Computer	V1	V2	V3	V4
HS	1			
MS	0			
Software				
CO		1	0	
OF		0	1	
CA		-1	-1	
Network				
LA				1
WF				0

C. Data collection

To collect data from the 3rd and the 4th year students, the questionnaire in our work is shown by Table 5. The total sample numbers of students are 173. There are 12 profiles ranking from 1 to 12. Rank 1 means the most important profile in this questionnaire.

Table 5 Questionnaire

Profile #	**Detail**	**Rank(1-12)**
1	HS-CO-LA	
2	HS-CO_WF	
3	HS-OF-LA	
4	HS-OF-WF	
5	HS-CA-LA	
6	HS-CA-WF	
7	MS-CO-LA	
8	MS-CO-WF	
9	MS-OF-LA	
10	MS-OF-WF	
11	MS-CA-LA	
12	MS-CA-WF	

D. Multivariate linear regression analysis

This process starts from finding average rank of each profile and identify the majority rank of all samples. Next, we change the rank value to the rating value so that the coefficients in regression analysis are positive value. The summary of variables rating are shown in Table 6.

Table 6 Summary of variables Rank 1-12 and Rating 1-12

Profile #	**Detail**	V1	V2	V3	V4	**Rank (1-12)**	**Rating (1-12)** V5
1	HS-CO-LA	1	1	0	1	4	9
2	HS-CO_WF	1	1	0	0	3	10
3	HS-OF-LA	1	0	1	1	2	11
4	HS-OF-WF	1	0	1	0	1	12
5	HS-CA-LA	1	-1	-1	1	5	8
6	HS-CA-WF	1	-1	-1	0	6	7
7	MS-CO-LA	0	1	0	1	9	4
8	MS-CO-WF	0	1	0	0	10	3
9	MS-OF-LA	0	0	1	1	7	6
10	MS-OF-WF	0	0	1	0	8	5
11	MS-CA-LA	0	-1	-1	1	11	2
12	MS-CA-WF	0	-1	-1	0	12	1

Then all the values in Table 6 are used to perform linear regression analysis with independent variables V1, V2, V3 and V4, and dependent variable V5. The results are shown in Table 7.

Table 7 Results of multivariate linear regression analysis

Model		**Unstandardized Coefficients**		**Standardized Coefficients**		
		B	**Std. Error**	**β**	**t**	**Sig.**
1	(Constant)	3.000	.529		5.672	.001
	V1	5.667	.611	.821	9.278	.000
	V2	1.750	.432	.414	4.052	.005
	V3	-2.250	.432	-.532	-5.210	.001
	V4	1.333	.611	.193	2.183	.065

E. Part worth utility and Total utility analysis

The results from Table 7 can be used to calculate the value of part worth utility and total utility as shown in Table 8.

Table 8 Results of Part worth utility and Total utility analysis

Attribute	Level	Part-utility	Range of utility	Important
Computer		Standardized-Coefficient (SC)	Max-Min	|SC/TMM|
	HS	0.821	(=0.821-0.179)	0.418
	MS	1-HS=0.179	0.642	0.091
Software				
	CO	0.414	(=1.118-0.414)	0.210
	OF	-0.532	0.704	0.270
	CA	1-CO-OF=1.118		0.243
Network				
	LA	0.193	(=0.807-0.193)	0.098
	WF	1-LA=0.807	0.614	0.411
		Total max-min (TMM)	1.960	

From linear regression analysis, the utility equation can be obtained and shown by equation (5)

$$y = 0.821V1 + 0.414V2 - 0.532V3 + 0.193V4 \quad (5)$$

with $R^2 = 0.945.$

IV. *Results*

A. Results of Part worth utility and Total utility analysis

From the results shown in Table 8 and the linear regression analysis, we can conclude as follows.

Attribute of "Computer" at level "High specification" has the priority value 0.418.

Attribute of "Network" at level "WIFI" has the priority value0 .411

Attribute of "Software" at level "Office" has the priority value 0.270

B. Factor clustering

From all of the calculated results, the computer laboratory should provide important services to students by the following equation,
(Computer - High specification) + (Software - Office) + (Network - WIFI).

So, the total most utility value is 1.099 ; (0.418 +0.270 + 0.411).

The least utility value is calculated by (Computer-Medium specification) + (Software-Compiler) + (Network-Lan).

Finally, the least total utility value is 0.399 ; (0.091+ 0.210 + 0.098).

V. Conclusions

In this research, we propose the method to find the factors that affect to student learning in computer laboratory services at the computer laboratory, the Faculty of Science, Chandrakasem Rajabhat University. The satisfactory score was collected from the information technology students by questionnaires. The analysis is done by Conjoint Analysis. The results show that the most important factor is the High performance computer. WIFI network and office software are also important factors to improve student learning skills. These research results can provide staff department at the university to plan hardware and software supports to improve student learning skills in the future.

VI. References

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