

Quality of ICT Facilities at the Tertiary Level Education in Bangladesh: Public versus Private University

H M Jahirul Haque and Faisal Mohammad Shahriar
 University of Liberal Arts Bangladesh, Dhaka, Bangladesh
 Email: jahirul.haque@ulab.edu.bd and faisal.shahriar@ulab.edu.bd

Abstract

The private and public universities of Bangladesh have taken significant initiatives in developing ICT facilities to ensure access to the state-of-the-art learning environment for their students. However, the impact of such initiatives is largely subjected to the studies on the perception of the very students using these facilities. The study focused on the students' perception about the quality of the ICT facilities available in public and private universities of Bangladesh in a comparative manner. Data for the study was collected from 265 students from 6 private and 3 public universities through a survey conducted on the perceived quality of ICT facilities in their respective institutions as expressed by 15 key indicators. Both descriptive and inferential analyses were used to test the hypotheses of the study. The study was conducted on a small scale and may be considered as a primer for future investigations. The outcomes of the study show that, perceived quality of the ICT facilities are mentionably different among the private and public university students, where private universities are performing better in 9 out of the 15 key indicators.

Keywords— ICT facilities, Private university, Public university, Quality.

© University of Liberal Arts Bangladesh
 All rights reserved.

Manuscript received on 17 November 2016 and accepted for publication on 27 November 2016.

1 INTRODUCTION

QUALITY, as a widely used term to express the performance of any system and process is largely defined by its technical and functional dimensions [1], [2]. Quality in education is an issue that has been signified and studied for a long time. A good number of studies have been conducted to investigate the dimensions of quality in higher education after the inception of the digital era in the later part of the 20th century, a mentionable few of which may be the works of Izquierdo [3], Madu & Kuei [4], Yorke [5], Hartman & Schmidt [6], and Ermer [7]. These studies commonly identified the availability and usefulness of ICT tools as significant determinants of quality in tertiary level education. Over the last two decades, ICT has become an indispensable component of education especially, at the tertiary level as a means of effective teaching and learning [8], [9], [10] and also adapting to globalization and societal requirements [11], [12]. As a result, ICT has significantly reshaped higher education through offering powerful learning environments and enhancing capabilities and skills of the students for cooperation, communication, problem solving and lifelong learning [13], [14], [15], [16], [17], [18], [19], [20], [21], [22]. However, the effectiveness of ICT is subjected to the availability and maintenance of the equipments and accessories [23]. Successful implementation of ICT therefore, requires strong intervention and support from institutions [24]. In recognition to the significance of ICT for quality education, the private and public universities of Bangladesh have taken strong initiatives to develop ICT facilities especially, for their students [25], although the private universities claim to have performed better in this regard [26]. Better infrastructure of ICT and wider access to ICT facilities have also been found to significantly contribute to the appeal of private universities among the prospective students in a good number of studies, for example Sabur [27], Lamagna [28], lamagna [29], Aminuzzaman [30] etc. This study is an initiative to investigate the quality of ICT facilities the private and public universities of Bangladesh from a students' point of view and empirically compare between performances of these two types of institutions in this regard. The outcomes of the study is based on the survey data from the students of 6 private and 3 public universities regarding 15 key indicators namely, Number of available computers (Num_PC), Printing facilities (Print_Fac), Condition of ICT equipments (Equip_Con), Power back-up facilities (PB_Fac), Availability of necessary software (Soft_Avail), User-friendliness of provided software (Soft_Use), Frequency of software updates (Soft_Up), Effectiveness of antivirus software (Eff_AV), Sufficiency of internet facilities (Int_Avail), Speed of internet (Int_Sp), Data sharing facilities (Data_Sh), Availability of ICT support staffs (Staff_Avail), Service quality of ICT support staffs (Staff_Qual), Timely solution of ICT related problems (Time_Sol) and Overall quality of ICT facilities (Over_Qual) that are derived from a previous study by Haque and Khan [31].

2 OBJECTIVES OF THE STUDY

The primary objective of the study is to investigate the perceived quality of ICT facilities among students of the private and public universities of Bangladesh. The other objective of the study is to determine if the private universities are performing better than the public universities in terms of the quality of ICT facilities for their students and if yes, then in which key indicator(s). The objectives of the study are addressed through analyzing survey data with quantitative techniques.

3 RESEARCH QUESTIONS

In accordance to the objectives, the research questions of the study are as follows:

- What is the present status of the key indicators of quality of the ICT facilities in the the private and public universities as perceived by the students?
- Are the private universities performing better in terms of quality of ICT facilities than that of the public universities and if yes, then in which key indicator(s)?

4 RESEARCH HYPOTHESES

The research question (a) would be satisfied with descriptive statistics alone and thus, would not require any hypothesis. For the research question (b), the null hypothesis (H_0) is that, there is no difference between the value of population mean of the key indicators of quality of ICT facilities in the private and the same in the public universities ($H_0: \mu_{i-Private} = \mu_{i-Public}$, where 'i' denotes the key indicators). As per the objective of the study, the alternative hypothesis (H_1) is that, the value population mean of the key indicators in the private universities are significantly higher than the same in the public universities ($H_1: \mu_{i-Private} > \mu_{i-Public}$).

5 METHODOLOGY

Snowball sampling technique has been adopted to build the two independent samples of the study, one from the private universities and the other from the public universities. The sample size for the private universities is 163, which includes students from 6 institutions namely Eastern University (EAU), International University of Business Agriculture and Technology (IUBAT), North-South University (NSU), Stamford University (STU), State University of Bangladesh (SUB), and University of Liberal Arts Bangladesh (ULAB). The sample size for the public universities on the other hand is 102, which includes students from 3 institutions namely, Bangladesh University of Engineering and Technology (BUET), Jagannath University (JNU), and University of Dhaka (DU). At present, there are 37 public and 91 private universities in Bangladesh. Therefore, to ensure equitability of data, the number of private and public universities taken under the study has been disproportionate. Data from the respondents were collected through questionnaire survey, a method which has been proven effective in similar studies [32], [33], [9]. The questionnaire recorded and measured the students' responses (ranging from strongly disagree to strongly agree) on a 5 point itemized rating scale namely, the Likert scale to statements regarding to the 15 key indicators of the quality of ICT facilities of their respective institutions. Likert scale is found effective in similar studies on students [34], [35],[36],[37]. Personal interviewing technique has been followed during the survey. The timeline of the survey has been January to April 2016. XLSTAT, a computerized statistical program has been used to analyze the survey data. A part of the analyses is descriptive, which has been suggested for this type of studies [38]. Parametric tests, namely Independent samples Z-test (upper-tailed) and Independent samples t-test (upper-tailed) have been conducted to test the research hypothesis. Although the data are technically ordinal, Grace-Martin [39], Lubke & Muthen [40] and Glass *et al.* [41] have implied that data from Likert scale with at least 5 categories can be used for parametric tests in some situations where the differences between the ordinal categories are considered equal. Norman [42], Labovitz [43], and Kim [44] also implied that, data from Likert scale is significantly capable of yielding accurate outcomes as like as continuous data.

6 DESCRIPTIVE STATISTICS

The the first sample of the study respondents of the study came from both public and private universities. The distribution of respondents in terms of universities and their types are shown in table 1:

TABLE 1
INSTITUTION WISE & CATEGORY WISE DISTRIBUTION OF THE RESPONDENTS

Serial	Institution Wise Distribution			Category Wise Distribution		
	Name	Frequency	Percentage	Category	Frequency	Percentage
1.	EAU	36	13.6	Private	163	61.5
2.	IUBAT	01	0.4			
3.	NSU	36	13.6			
4.	STU	34	12.8			
5.	SUB	26	9.8			
6.	ULAB	30	11.3			
7.	BUET	32	12.1	Public	102	38.5
8.	DU	35	13.2			

9.	JNU	35	13.2			
-	Total	265	100.0	Total	265	100.0

The responses of the students regarding to the key indicators of the ICT facilities (or variables) according to the type of institution are shown in table 2 and a graphical projection of the mean scores of the responses from the two samples is given in the figure 1 followingly:

TABLE 2
SUMMARY OF THE RESPONSES

Serial	Variables	Type of Institution		Difference (point)	Difference (percent)
		Mean (Private Univ.)	Mean (Public Univ.)		
1.	Number of PC (Num_PC)	3.45	3.25	0.20	4.0
2.	Printing facilities (Print_Fac)	3.32	2.45	0.87	17.4
3.	Condition of ICT equipments (Equip_Con)	3.49	2.91	0.58	11.6
4.	Power back-up facilities (PB_Fac)	3.71	2.63	1.08	21.6
5.	Availability of necessary software (Soft_Avail)	3.33	2.89	0.44	8.8
6.	User-friendliness of provided software (Use_Soft)	3.61	2.95	0.66	13.2
7.	Frequency of software updates (Soft_Up)	3.29	2.51	0.78	15.6
8.	Effectiveness of antivirus software (Eff_AV)	3.17	2.48	0.69	13.8
9.	Sufficiency of internet facility (Int_Avail)	3.56	3.28	0.28	5.6
10.	Speed of Internet (Int_Sp)	3.19	3.11	0.08	1.6
11.	Data sharing facilities (Data_Sh)	3.19	3.11	0.08	1.6
12.	Availability of ICT support staffs (Staff_Avail)	3.50	3.29	0.21	4.2
13.	Service quality of ICT support staffs (Staff_Qual)	3.55	3.45	0.10	2.0
14.	Timely solution of ICT related problem (Time_Sol)	3.52	3.32	0.20	4.0
15.	Overall quality of ICT facilities (Over_Qual)	3.58	3.19	0.39	7.8

Note: 1) The number of response for private and public university is 163 and 102 respectively
 2) No missing value were found
 3) The minimum and maximum response score is 1 and 5 respectively

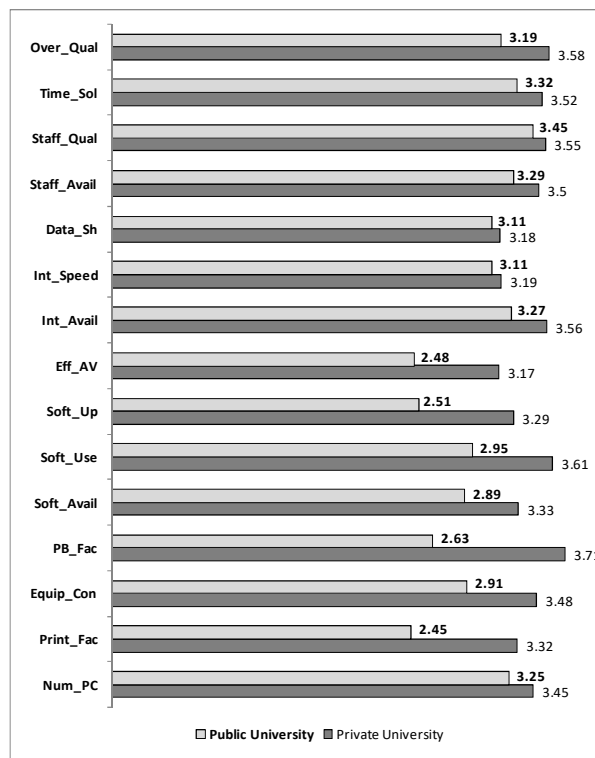


Figure 1: Mean score of responses on the key indicators of the quality of ICT Facilities from private and public universities.

From the descriptive data, it can be seen that the mean scores of responses from the students of private universities are higher than that of the public universities for all the 15 key indicators. However, the contrast is significant for variables like facilities available at the universities namely, Printing facilities (Print_Fac), Condition of ICT equipments (Equip_Con), Power back-up facilities (PB_Fac), User-friendliness of provided software (Sof_Use), Frequency of software updates (Soft_Up), and Effectiveness of antivirus software (Eff_AV) where the scores of private universities exceed the same from public universities on a range of 0.58 to 1.08 on a 5 point scale (11.6 to 21.6 percent).

7 PARAMETRIC TEST

7.1 Independent Samples Z-test

An 'Independent-Samples' Z-test (upper-tailed) has been conducted to test the null hypotheses (H_0) that the value of the population mean of the key indicators of the quality of ICT facilities in the private universities are equal to the same in the public universities with a precision level (α) of 0.05. The alternative hypothesis (H_1) was that the value of the population mean is higher for the private universities than the same in the public universities. The outcomes of the test are shown in the Table 3 below:

TABLE 3
INDEPENDENT SAMPLES Z-TEST (UPPER-TAILED)

Variables	Difference between means	z (Observed)	z (Critical)	p-value (upper-tailed)	H_0
Num_PC	0.203	1.070	1.645	0.142	Accepted
Print_Fac	0.868	5.120	1.645	< 0.0001	Rejected
Equip_Con	0.573	3.441	1.645	0.000	Rejected
PB_Fac	1.078	6.266	1.645	< 0.0001	Rejected
Soft_Avail	0.439	2.674	1.645	0.004	Rejected
Use_Soft	0.656	3.705	1.645	0.000	Rejected
Soft_Up	0.779	4.649	1.645	< 0.0001	Rejected
Eff_AV	0.685	3.996	1.645	< 0.0001	Rejected
Int_Avail	0.284	1.659	1.645	0.049	Rejected
Int_Sp	0.082	0.472	1.645	0.318	Accepted
Data_Sh	0.076	0.454	1.645	0.325	Accepted
Staff_Avail	0.203	1.188	1.645	0.117	Accepted
Staff_Qual	0.095	0.576	1.645	0.282	Accepted
Time_Sol	0.192	1.213	1.645	0.113	Accepted
Over_Qual	0.390	2.218	1.645	0.013	Rejected

Note: 1) $H_0 : \mu_i\text{-Private} = \mu_i\text{-Public}$, $H_1 : \mu_i\text{-Private} > \mu_i\text{-Public}$

The outcomes of the Z-test show that, the p -values for the 6 out of 15 key indicators namely, number of available computers (Num_PC), speed of internet (Int_Sp), data sharing facilities (Data_Sh), availability of ICT support staffs (Staff_Avail), services quality of ICT support staffs (Staff_Qual) and timeliness of solutions of ICT related problems (Time_Sol) are not significant. Therefore, the null hypothesis is accepted for these key indicators, implying that there is no difference between the values of population mean for these key indicators in the private and public universities. On the other hand, the p -values for printing facilities (Print_Fac), condition of ICT equipments (Equip_Con), power backup facilities (PB_Fac), availability of necessary software (Soft_Avail), user-friendliness of provided software (Soft_Use), frequency of software updates (Soft_Up), effectiveness of antivirus software (Eff_AV), sufficiency of internet facilities (Int_Avail) and overall quality of ICT facilities (Over_Qual) are significant. Therefore, the null hypotheses for these key indicators are rejected, implying that the values of the population mean for these key indicators are higher in the private universities than the same in the public universities.

7.2 Independent Samples t-test

An 'Independent-Samples' t -test (upper-tailed) has also been conducted to test the null hypotheses (H_0) that the mean scores of the 15 key indicators of the quality of ICT facilities of the private universities are equal to that of the public universities with a precision level (α) of 0.05. The alternative hypothesis (H_1) was that the mean scores are higher for the private universities than that of the public universities. The t -test was followed by a 'Fisher's F-test' for equality of the variances (two-tailed) to approximate the degrees of freedom (df) for the t -test. The outcome of the F-test is shown in the Table 4 below:

TABLE 4

FISHER'S F-TEST FOR EQUALITY OF VARIANCES (TWO-TAILED)

Variables	Ratio	F (Observed)	F (Critical)	p-value (one-tailed)	H ₀	Equal variances assumed
Num_PC	0.720	0.720	1.434	0.063	Accepted	Yes
Print_Fac	0.801	0.801	1.434	0.208	Accepted	Yes
Equip_Con	0.681	0.681	1.434	0.029	Rejected	No
PB_Fac	0.725	0.725	1.434	0.068	Accepted	Yes
Soft_Avail	0.898	0.898	1.434	0.538	Accepted	Yes
Use_Soft	0.742	0.742	1.434	0.091	Accepted	Yes
Soft_Up	0.946	0.946	1.434	0.747	Accepted	Yes
Eff_AV	1.100	1.100	1.434	0.608	Accepted	Yes
Int_Avail	0.783	0.783	1.434	0.166	Accepted	Yes
Int_Sp	0.908	0.908	1.434	0.582	Accepted	Yes
Data_Sh	1.098	1.098	1.434	0.615	Accepted	Yes
Staff_Avail	0.763	0.763	1.434	0.126	Accepted	Yes
Staff_Qual	0.671	0.671	1.434	0.024	Rejected	No
Time_Sol	0.847	0.847	1.434	0.346	Accepted	Yes
Over_Qual	0.587	0.587	1.434	0.002	Rejected	No

Note: H₀: Ratio between the variances = 1; df1 = 162, df2 = 101; $\alpha = 0.05$

The outcome of the F-test shows that equality of variances between the two samples of the study can be assumed for all except 3 of the 15 key indicators. The 3 key indicators assumed to have unequal variances are condition of ICT equipments (Equip_Con), services quality of ICT support staffs (Staff_Qual) and overall quality of ICT facilities are significant (Over_Qual). The degrees of freedom (*df*) for these 3 indicators are 185, 183 and 174 respectively. The degrees of freedom (*df*) for all other variables are 263. The outcome of the *t*-test is shown in the Table 5 below:

TABLE 5
INDEPENDENT SAMPLES T-TEST (UPPER-TAILED)

Variables	<i>df</i>	Difference between means	t (Observed)	t (Critical)	p-value (upper-tailed)	H ₀
Num_PC	263	0.203	1.111	1.651	0.134	Accepted
Print_Fac	263	0.868	5.252	1.651	< 0.0001	Rejected
Equip_Con	185	0.573	3.441	1.653	0.000	Rejected
PB_Fac	263	1.078	6.501	1.651	< 0.0001	Rejected
Soft_Avail	263	0.439	2.708	1.651	0.004	Rejected
Use_Soft	263	0.656	3.834	1.651	< 0.0001	Rejected
Soft_Up	263	0.779	4.678	1.651	< 0.0001	Rejected
Eff_AV	263	0.685	3.952	1.651	< 0.0001	Rejected
Int_Avail	263	0.284	1.706	1.651	0.045	Rejected
Int_Sp	263	0.082	0.477	1.651	0.317	Accepted
Data_Sh	263	0.076	0.449	1.651	0.327	Accepted
Staff_Avail	263	0.203	1.226	1.651	0.111	Accepted
Staff_Qual	183	0.095	0.576	1.651	0.283	Accepted
Time_Sol	263	0.192	1.237	1.651	0.109	Accepted
Over_Qual	174	0.390	2.218	1.651	0.014	Rejected

Note: 1) H₀ : $\mu_{\text{Private}} = \mu_{\text{Public}}$, H₁ : $\mu_{\text{Private}} > \mu_{\text{Public}}$

2) The degrees of freedom (*df*) for the test is approximated by the Welch-Satterthwaite formula as per the outcomes of the Fisher's F-test

The outcome of the *t*-test is completely similar to that of the Z-test described above. The *t*-test has accepted and rejected the hypotheses for the same variables as seen in the Z-test. Therefore, the interpretations of the Z-test are found to be the same in this

case. Thus it can be strongly inferred that, the private universities are showing better performance in ensuring quality for 9 of the 15 key indicators.

8 IMPLICATIONS AND CONCLUSION

The study, although conducted on a limited scale, projects that the perceived quality of the ICT facilities from the students' point of view in the private universities are higher than the same in the public universities on a number of key indicators. Nevertheless, the perceived quality on the other key indicators are not significantly different for the private and public universities. Therefore, it is not conclusive that the private universities are absolutely out-performing the public universities in terms of quality of the ICT facilities. Moreover, there are still significant scopes for both the private and public universities regarding the quality of ICT facilities even though the private universities may score higher in this regard. It is indeed an issue to consider that none of the variables in the study scored a mean value of 4 or higher in a 5-point scale, which shows a rather poor perception among the students about the capability and performance of the universities in providing state-of-the-art ICT facilities. One reason for this low level of perception might be that the students mostly use ICT facilities (i.e. computers, internet) at their own while they are at the university campus [45]. Therefore, they might not have definite attitudes towards the ICT facilities provided by their institutions. The outcome of the study is tentative in consideration of depth and rigor, and should be considered as a primer for further studies on this issue. It is therefore suggested that studies on larger sample with pre-screened respondents should be conducted to draw a true picture of the ICT scenario from the students' point of view.

REFERENCES

- [1] C. Gönroos, *Service Management and Marketing*, Massachusetts: Lexington Books, 1990
- [2] U. Lehtinen, and J.R. Lehtinen, "Two approaches to service quality dimensions", *The Service Industries Journal*, vol. 11, no. 3, pp. 287-303, 1991
- [3] F.A. Izquierdo, "Quality-designed curricula", *European Journal of Engineering Education*, vol. 18, no. 4, pp. 339-344, 1993
- [4] C.N. Madu, and C. Kuei, "Dimensions of Quality Teaching in Higher Education", *Total Quality Management*, vol. 4, no. 3, pp. 325-338, 1993
- [5] M. Yorke, "Self-scrutiny of quality in higher education: a questionnaire", *Quality Assurance in Education*, vol. 3, no. 1, pp. 10-13, 1995
- [6] D.E. Hartman, and S.L. Schmidt, "Understanding student/alumni satisfaction from a consumer's perspective," *Research in Higher Education*, Vol. 36 No. 2, pp. 197-217, 1995
- [7] D.S. Ermer, "Using QFD Becomes an Educational Experience for Students and Faculty", *Quality Progress*, vol. 28, no.5, pp. 131-136, 1995
- [8] M.A. Hossain, M.A. Salam, and F. Shilpi, "Readiness and Challenges of Using Information and Communications Technology (ICT) in Higher Education of Bangladesh", *The Online Journal of New Horizons in Education*, vol. 6, no. 1, pp. 123-132, 2016
- [9] A.K. Bairagi, S.A.A. Rajon, and T. Roy, "Status and Role of ICT in Educational Institution to Build Digital Society in Bangladesh: Perspective of a Divisional City, Khulna", *International Journal of Advances in Engineering & Technology*, vol. 1, no. 4, pp. 374-383, 2011
- [10] M. Dunmill, and A. Arslanagic, "ICT in Arts Education A Literature Review", *Report: the Te Puna Puoru National Centre for Research in Music Education and Sound Arts, University of Canterbury, New Zealand, July 2006.*
available: <http://artsonline2.tki.org.nz/documents/ICTinArtsEducationALiteratureReview.pdf> (accessed: 31 May 2016)
- [11] M.S. Islam, and M.N. Islam, "Use of ICT in Libraries: An Empirical Study of Selected Libraries in Bangladesh", *Library Philosophy and Practice (e-journal)*, paper 143, Aug. 2007, available: <http://www.webpages.uidaho.edu/~mbolin/shariful.pdf> (accessed: 27 May 2016)
- [12] C. Blurton, "New Directions of ICT-Use in Education", *World Communication and Information Report, UNESCO, 1999*
- [13] J. Pulkkinen, "Cultural globalization and integration of ICT in education" in K. Kumpulainen (Ed.), *Educational technology: Opportunities and challenges*, pp. 13-23, 2007, Oulu, Finland: University of Oulu
- [14] D. Wood, "Theory, training, and technology: Part I.", *Education and Training*, vol. 37, no. 1, pp. 12-16, 1995
- [15] M. Volman, and E.V. Eck, "Gender Equity and Information Technology in Education: The Second Decade," *Review of Educational Research*, vol. 71, no. 4, pp. 613-634, 2001
- [16] T. Plomp, W.J. Pelgrum, and N. Law, "SITES2006—International comparative survey of pedagogical practices and ICT in education," *Education and Information Technologies*, vol. 12, no. 2, pp. 83-92, 2007
- [17] S. Mumtaz, "Factors Affecting Teachers' Use of Information and Communications Technology: A review of the Literature," *Journal of Information Technology for Teacher Education*, vol. 9, no. 3, pp. 319-342, 2000
- [18] C.R. Casal, "ICT for Education and Development," *info*, vol. 9, no. 4, pp. 3-9, 2007
- [19] R. Kozma, "National Policies that Connect ICT-Based Education Reform to Economic and Social Development," *Human Technology*, vol. 1, no. 2, pp. 117-156, 2005
- [20] I. Bhattacharya, and K. Sharma, "India in the Knowledge Economy – An Electronic Paradigm," *International Journal of Educational Management*, vol. 21, no. 6, pp. 543-568, 2007
- [21] K. Pajo, and C. Wallace, "Barriers to the uptake of web-based technology by university teachers", *Journal of Distance Education*, vol. 16, pp. 70-84, 2001
- [22] J. Voogt, "Consequences of ICT for Aims, Contents, Processes and Environments of Learning" in J. van den Akker, W. Kuiper, & U. Hameyer (Eds.), *Curriculum landscapes and trends*, pp. 217-236, Dordrecht: Kluwer, 2003
- [23] M.S.H. Khan, M. Hasan, and C.K. Clement, "Barriers to the Introduction of ICT into Education in Developing Countries: The Example of Bangladesh," *International Journal of Instruction*, vol. 5, no. 2, pp. 61-80, 2012
- [24] M. Cross, and F. Adam, "ICT Policies and Strategies in Higher Education in South Africa: National and Institutional Pathways," *Higher Education Policy*, vol. 20, no. 1, pp. 73-95, 2007
- [25] M. Roknuzzaman, "A Survey of Internet Access in a Large Public University in Bangladesh," *International Journal of Education and Development using ICT (e-journal)*, vol. 3, no. 2, 2006, available: <http://ijedict.dec.uwi.edu/viewarticle.php?id=195&layout=html> (accessed: 27 May 2016)

- [26] M.R. Jewel, "An Empirical Study on the challenges and prospects of Private Universities in Higher Education in Bangladesh," *Proc. International Conference on Tertiary Education (ICTERC 2013)*, Daffodil International University, Dhaka, Bangladesh, pp. 117-123, Jan. 2013, available: <http://dspace.library.daffodilvarsity.edu.bd:8080/bitstream/handle/123456789/879/AnEmpiricalStudyontheChallengesandProspectsofPrivateUniversitiesinHigherEducationinBangladesh.pdf?sequence=1> (accessed: 17 July 2016)
- [27] M. A. Sabur, "Dhaka University verses private university: A comparative analysis of quality of education offered by the institutions", BSS dissertation, University of Dhaka, Bangladesh, 2004
- [28] C.Z. Lamanga, *Strategic view of the development of Higher Education: Bangladesh AIUB perspective*, Bangladesh Business Year Book, Dhaka: A1 Publication, 2002
- [29] C.Z. Lamanga, "Quality Assurance in Tertiary Education: Bangladesh Experience", *Seminar paper: The World Bank Learning Seminar, CIEP, France*, Jun. 2006
- [30] S. Aminuzzaman, "Overview of quality assurance in the context of Bangladesh," *Workshop paper: American International University Bangladesh, Dhaka, Bangladesh*, 2007
- [31] H.M.J. Haque, and M.H. Khan, "Quality of ICT Services at Higher Educational Institutions of Bangladesh," *ULAB Journal of Science and Engineering*, vol. 1, no. 1, pp. 42-47, 2010
- [32] M.S. Islam, and M.H. Fouji, "The Impact of ICT on Students' Performance: A Case Study of ASA University Bangladesh," *ASA University Review*, vol. 4, no. 2, pp. 101-106, 2010
- [33] N. Abdelaziz, J. Shahrir, and C.H. Leng, "Measuring Attitude Toward Computer and Internet Usage among Postgraduate Students in Malaysia," *The Turkish Online Journal of Educational Technology*, vol. 12, no. 2, pp. 200-216, 2013
- [34] J. Dorup, "Experience and attitudes towards information technology among firstyear medical students in Denmark: Longitudinal questionnaire survey," *Journal of Medical Internet Research*, vol. 6, no. 1:e-10, 2004, DOI: 10.2196/jmir.6.1.e10. Available: <http://www.jmir.org/2004/1/e10/> (accessed: 31 May 2016)
- [35] G. Gay, S. Mahon, D. Devonish, P.A. Alleyne, and P.G. Alleyne, "Perceptions of information and communication technology among undergraduate management students in Barbados", *International Journal of Education and Development using Information and Communication Technology*, vol. 2, no. 4, pp. 6-17, 2006
- [36] J. Peeraer, and P.V. Petegem, "Factors Influencing Integration of ICT in Higher Education in Vietnam", *Proc. Global Learn 2010, Association for the Advancement of Computing in Education (AACE)*, Penang: Malaysia, pp. 916-924, May 2010. Available: http://www.vvob.be/vietnam/files/SubmissionGlobalLearnJP_v2.pdf (accessed: 28 May 2016)
- [37] M. Drent, and M. Meelissen, "Which factors obstruct or stimulate teacher educators to use ICT innovatively?", *Computers & Education*, vol. 51, no. 1, pp. 187-199, 2008
- [38] J. Cohen, "Multiple Regression as a General Data-Analytic System", *Psychological Bulletin*, vol. 70, no. 6, pp. 426-443, 1968
- [39] K. Grace-Martin, "Can Likert Scale Data ever be Continuous?", available: <http://www.theanalysisfactor.com/can-likert-scale-data-ever-be-continuous/>, 2008. (accessed: 01 June 2016)
- [40] G.H. Lubke, and B.O. Muthen, "Applying Multigroup Confirmatory Factor Models for Continuous Outcomes to Likert Scale Data Complicates Meaningful Group Comparisons", *Structural Equation Modeling*, vol. 11, pp. 514-534, 2004
- [41] G.V. Glass, P.D. Peckham, and J.R. Sanders, "Consequences of failure to meet assumptions underlying the analyses of variance and covariance", *Review of Educational Research*, vol. 42, pp. 237-288, 1972
- [42] G. Norman, "Likert Scales, Levels of Measurement and the 'laws' of statistics", *Advances in health sciences education*, vol. 15, no. 5, pp. 625-632, 2010
- [43] S. Labovitz, "The assignment of numbers to rank order categories", *American Sociological Review*, vol. 35, pp. 515-524, 1970
- [44] Jae-On Kim, "Multivariate analysis of ordinal variables revisited", *American Journal of Sociology*, vol. 84, pp. 448-456, 1978
- [45] G. Rabbani, and S. Chowdhury, "Quality of Higher Education in Bangladesh: Governance Framework and Quality Issues," *Beykent University Journal of Social Sciences*, vol. 7, no. 1, pp. 78-91, 2014

APPENDIX

Survey Questionnaire

Quality of ICT Facilities at Tertiary Level Education of Bangladesh

Dear Respondent, Thank you very much for participating in the survey. The purpose of the study is purely academic. Your information and identity shall not be disclosed to anyone else.

Instruction: Please put Tick mark on the correct option. Write down appropriate data where applicable.

1. Name of your university:

2. Your study program and current study level (year/semester):

3. The number of computers available in the for the use of the students is satisfactory:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
----------------	-------	----------------------------	----------	-------------------

4. Printing facilities available for students in the university is satisfactory:

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree
----------------	-------	----------------------------	----------	-------------------

5. The condition of the ICT equipments (i.e. computers, printers, projectors) in the university are satisfactory:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

6. Power backup support (i.e. UPS) for computers in the university is satisfactory:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

7. Necessary softwares are widely available at the university for students' usage:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

8. Software provided by the univeristy for students' usage is user friendly and easy:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

9. Software provided by the univeristy are up-to-date and are regularly updated:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

10. Antivirus software provided by the univeristy is effective:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

11. Internet facilities for students at the university is sufficient:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

12. The speed of internet at the university is satisfactory:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

13. Data sharing facilities through internal network (i.e. LAN) at the university is satisfactory:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

14. Supporting staffs for IT related issues are available whenever necessary:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

15. The service quality of the IT staff(s) is satisfactory:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

16. IT related services and solutions are timely provided to students at the university:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

17. The overall quality of ICT realted services at the university is satisfactory:

<i>Strongly Agree</i>	<i>Agree</i>	<i>Neither Agree nor Disagree</i>	<i>Disagree</i>	<i>Strongly Disagree</i>
-----------------------	--------------	-----------------------------------	-----------------	--------------------------

18. Please provide us your email address and cell phone number in case we need to contact you for further queries:

-----Thank You-----

H M Jahirul Haque received his PhD in computer engineering from Kharkov National University of Radio Electronics, Ukraine in July 2001 and Masters in Technical Sciences (Systems Engineering) from Cherkassy State Technological University, Ukraine in 1995. After serving the Leading University, Sylhet, Bangladesh as the Head of the Department of Computer Science and Engineering, he joined the University of Liberal Arts Bangladesh (ULAB) in 2004. Now he is a Professor in the Department of Computer Science and Engineering and holds the position of Dean of the School of Science and Engineering at the university. Additionally, he is the Pro Vice Chancellor of ULAB. Dr. Haque is currently devoted in education related research as he is dealing with academic and faculty development related issues at ULAB. He has worked with different reputed universities of UK, USA, Australia, Japan, Ukrain and Russia in different capacities.

Faisal Mohammad Shahriar received his BBA and MBA in Marketing from the University of Dhaka, Bangladesh. After serving the Leading Univeristy in Sylhet, Bangladesh and the State University of Bangladesh in Dhaka, Bangladesh as a faculty member, he is currently an Assistant Professor in the School of Business of the University of Liberal Arts Bangladesh (ULAB). He is also a PhD research fellow in the University of Dhaka. Mr. Shahriar has been pursuing research studies on the areas of tourism, social media & ICT and consumer behavior.