An Empirical Investigation of Bangladeshi Websites from a Gender Perspective

by

Rakshanda Mehnaz Huq
18341018
Tasneem Batool
15101057
Tanin Ibne Sahaz Dipto
15101028
MD. Suhayel Rahman
15101076

A thesis submitted to the Department of Computer Science and Engineering
in partial fulfillment of the requirements for the degree of
B.Sc. in Computer Science

Department of Computer Science and Engineering
Brac University
April 2019

Declaration

It is hereby declared that

1. The thesis submitted is my/our own original work while completing degree at Brac University.
2. The thesis does not contain material previously published or written by a third party, except where this is appropriately cited through full and accurate referencing.
3. The thesis does not contain material which has been accepted, or submitted, for any other degree or diploma at a university or other institution.
4. We have acknowledged all main sources of help.

Student's Full Name & Signature:

Rakshanda Mehnaz Huq 18341018	Tasneem Batool 15101057
Tanin Ibne Sahaz Dipto 15101028	MD.Suhayel Rahman 15101076

Approval

The thesis/project titled "An Empirical Investigation of Bangladeshi Websites from a Gender Perspective." submitted by

1. Rakshanda Mehnaz Huq (18341018)
2. Tasneem Batool (15101057)
3. Tanin Ibne Sahaz Dipto (15101028)
4. MD. Suhayel Rahman (15101076)

Of Spring, 2019 has been accepted as satisfactory in partial fulfillment of the requirement for the degree of B.Sc. in Computer Science on April, 2019.

Examining Committee:

Supervisor:
(Member)

Hossain Arif
Assistant Professor
Department of Computer Science and Engineering
BRAC University

Program Coordinator:
(Member)

Dilruba Showkat
Lecturer
Department of Computer Science and Engineering
BRAC University

Head of Department:
(Chair)

MD. Abdul Mottalib, PhD
Professor and Chairperson
Department of Computer Science and Engineering
BRAC University

Abstract

Gender inclusiveness in computing settings is receiving a lot of attention, but one potentially critical factor has mostly been overlooked: Websites. In this paper, we present the investigation which is a multiple case field study of two websites of different categories through experimental lab study and user surveys. We also investigate to understand if there is a psychological difference when it comes to self-efficacy, processing of information and tinkering between both genders. Our experimental result has shown significant difference in the Self-efficacy where males are seen to be more confident while working in computing settings than females. Using the ANOVA Calculator the p-value of self-efficacy is 0.000085 which is significant at p¡0.01. Also, we tested the tinkering tendencies of males and females, the effect of which was a negative correlation between Tinkering and Time Taken to finish the tasks on BRAC University website, the Pearson value was -0.729. The Fisher Exact Test value, 0.0911 is greater than 0.05, showing a significant difference between the Tinkering of males and females. Furthermore, while processing information, males and females are known to follow different approaches. It is found that, participants' task success had a positive correlation with Selective Information processing in BRAC University website, with a Pearson value of 0.658. The overall task completion rate of female participants is 44.65 percent and that of male participants is 66.05 percent, on the selected websites showing a notable difference. Hence, our empirical investigation proposes the relevance of accounting for gender differences when it comes to building websites, softwares or any Information Technology(IT) systems, which has not been considered yet in Bangladesh.

Keywords: Human Computer Interaction; Bangladeshi Websites; Gender Inclusiveness; Self-efficacy; Information Processing Style; Tinkering; Pearson and Spearman's Correlation; Linear Regression Analysis

Acknowledgement

Firstly, thanks to the Almighty Allah for enabling us to complete this research successfully.
Secondly, we express our gratitude to our Supervisor Hossain Arif sir, and Co-supervisor Dilruba Showkat ma'am, for their contribution and guidance in supporting us throughout this research.
Lastly, but not the least, we would like to thank our parents for their constant and immense support throughout our lives.

Table of Contents

Declaration i

Approval ii

Abstract iii

Acknowledgment iv

Table of Contents v

List of Figures vii

List of Tables viii

1 Introduction 1
- 1.1 Computer Self-efficacy . . . 1
- 1.2 Information Processing Styles . . . 2
- 1.3 Willingness to Tinker . . . 2
- 1.4 Objective . . . 2

2 Related Work 4

3 Methodology and Design of Study 7
- 3.1 Task Design . . . 7
- 3.2 How and Where . . . 8
- 3.3 Participants . . . 9
- 3.4 Data Collection . . . 9
- 3.5 Analysis of Data . . . 10
- 3.6 Code Set and Rules . . . 10

4 Data Analysis 11
- 4.1 Pilot Study . . . 11
- 4.2 Final Study . . . 12

5 Results of Linear regression and Correlation 18

6 Conclusion and Future Works 20
- 6.1 Answer to RQ1: . . . 20
- 6.2 Answer to RQ2: . . . 20
- 6.3 Answer to RQ3: . . . 20

6.4 Limitations of this Investigation: 20
6.5 Future Works: 21

Bibliography **23**

Appendix **24**

List of Figures

4.1 Averages of the task performances. 13
4.2 A graphical representation of the percentage of task completion of both genders, with respect to the websites. 14
4.3 A graphical breakdown of Completion Percentage of each Task using GrameenPhone website. 14
4.4 A graphical breakdown of Completion Percentage of each Task using BRAC university website. 15
4.5 The result of Independent Samples using Confidence Interval Calculator. The above data generates an interval estimate of the difference between two population Means. It can be said with 90 percent confidence that, the difference between the two population Means lies between 65.181645 and 75.103955. 15
4.6 The box-plot representation of Self-Efficacy scores. 16
4.7 Binary values that represent the likelihood of Tinkering. 16
4.8 The result of Tinkering using Fisher Exact Test Calculator. This is a notable difference between the Tinkering of males and females since the P-value 0.0911 is greater than 0.05. 17
4.9 The Comprehensive and Selective scores of both the genders in the Fisher Exact Test. P-value equals 0.5721. 17

5.1 Linear regression showing positive correlation between Task Score and Self-efficacy score, GP website. 19

6.1 24
6.2 25
6.3 The Pre Task form, completed before the starting with the websites . 26
6.4 The tasks performed by the participants 26
6.5 27
6.6 27
6.7 The Post-task form that was completed after the participants were done with the website tasks. 28
6.8 29
6.9 BRAC University website 30
6.10 31
6.11 GrameenPhone website 32
6.12 The .csv formatted file imported to the R source code, containing the collected data and scores of each participant. 33

List of Tables

3.1: Participant Demographic.....9
4.1: Summary of Results of Pilot Study.....11
4.2: Results from Pre-task form, Self-efficacy scores.....12
4.3 The Mean and SD of Self-efficacy scores according to the sample size, using ANOVA calculator.....12

Chapter 1

Introduction

A significant number of research has successfully revealed the issue of gender inclusiveness in various computing situations, spanning education on the field of Science, Technology, Engineering and Mathematics (STEM), including the computing workforce. There has also been numerous efforts to unravel these problems, such as changes in information, workforce or education climate. However, none of these efforts consider the websites that people use on a daily basis, for its wide range of functionalities. Evidence has emerged over the past decade that, lack of females' involvement in the field of technology is subtly undermining females' problem-solving abilities[1]. The published paper on, Cross-National Patterns of Gender Differences in Mathematics: A Meta-Analysis presented gender gap and the shortage of females in the career oriented from the fields of STEM. A major factor is the culture variations in the opportunity structures for women and girls throughout 69 different nations. The mean effect and standard deviation values were found out to represent both gender similarity and gender stratification hypotheses. According to the findings, despite the very small difference in the academic achievement of males and females in the field of mathematics, the attitude and affect towards the career path is much more positive for men, usually working at a higher status compared to women. It is believed that such inequity can be reduced by the education system, beginning from schools, by ensuring to provide quality curriculum and instructions. Also, the proper value placed by the society on both genders towards learning mathematics can bring about considerable improvements.

Furthermore, recent analysis has shown that the ways individuals use websites' features often cluster by gender, also, many websites features are unwittingly designed around the way males tend to work. Finding of gender differences in website production and preference aesthetics has important implications for multiple purposes and assessment. Otherwise, these websites' actual purpose is not served. In fact, research shows (at least) three factors that can directly impact the ways in which males and females use websites:

1.1 Computer Self-efficacy

This refers to how much self-confidence a person has when it comes to handling or completion of a specific task using any information system. A person with a high self -efficacy has a high probability of successfully achieving their goals using the system.

This also relates to what tools they use or how they manage to overcome difficulties and how plausible males and females are to explore while using technology. This is an important factor because it involves a person's decision on whether they will buy, learn to use, and work with a software or an information system. In [3], the research initiates the approach of providing a tutorial for a software package which can be useful in business organizations. Naturally people who had greater experience in using computers were more comfortable using it initially. The hands-on tutorial resulted in an increase in the employees' confidence to use the software package and its necessary tools. However, they found a difference in how males and females perceived the tutorial. The study was conducted on MBA students, of which fifty-two were males and twenty-eight were females. They completed questionnaires before and after going through the tutorial which indicated their level of confidence. Females increase in confidence reflected to be greater than males after learning through the tutorial, although initially males were more confident than females.

1.2 Information Processing Styles

While carrying out any task the human mind processes information, in different ways, past research has developed a selectivity hypothesis which describes females as comprehensive processors and males as heuristic or selective processors.[5] Heuristic processing is when only chunks of information that is relevant to the current context of use is perceived and applied accordingly. Comprehensive processing is going through the whole available content to gain a general summary before moving on to a task. In [5], various education research were analyzed that confirmed that females outperformed males mainly due to their different approaches in processing information. An evaluation task was performed involving thirty-six males and thirty-three females, containing equal numbers of confirming and disconfirming cues. The participants rated these cues according to their hypothesis. The results have reflected the difference in information processing styles, although the rating of confirming information did not vary much among the different genders.

1.3 Willingness to Tinker

This is about how much interested a person is to explore new features of a software or a website they use. Also, how they can make use of their discoveries of the various tools at hand. According to earlier research males are likely to tinker more than females. Studies have also shown, playing and exploring with tools is an essential way of learning to use technology, to achieve various personal and organizational goals. In [12], a workshop was conducted, "Tinkering in Scientific Education", which aimed to enable the participants in developing different techniques and abilities to tinker. This was proved to be a very beneficial approach.

1.4 Objective

To substantiate, whether these findings also apply to the demographics of Bangladesh, and subsequently deliver these findings to the website owners, we have started this research. Our goal is to enable past gender research to make a difference in today's

design, which can be made equally user-friendly for both males and females. Hence, we structured our investigation around the following research questions:

RQ1: Is there any noteworthy difference between males' and females' self-efficacy using these websites of an university and an IT/ telecommunication organization?
RQ2: Are males more keen to tinker with the available functionalities than females?
RQ3: Is the notion, that describes females as comprehensive processors and males as heuristic processors, applicable for the demographic that we have selected?

Chapter 2

Related Work

Gender bias is an inclination or partiality toward one gender over the other. The World Wide Web was developed prominently by male engineers.[17]. Consequently, a gender bias has been observed through the study of Gender Human-Computer Interaction (Gender HCI) in the area of user interface design, particularly on the Internet where a vast majority of websites are developed by men and are seen to be more compatible with male users.[10]. This bias can be conscious or oblivious, and may show from numerous points of view, both unobtrusive and self-evident. Although numerous authentic models and proof propose that bias has commonly conflicted with women, there are contrary cases despite what might be expected. In [10], an experiment was designed and conducted to test the hypothesis that gender neutrality in the interface design yields a higher usability score compared to other traditional user interfaces. Three different interfaces was designed, one of which was male biased, the other had a female bias and the last design maintained neutrality. Both male and female users used the three interfaces, this was done in order to merge male and female targeted design principles which proved to be fruitful. The highest usability scores, derived from the performance of both the genders, was from the interface without any bias.

However insignificant gender biases in websites might seem, it is the root of the bigger gender discrimination problems. Subconsciously people are still made to believe that tinkering with new tools, softwares and websites are prioritized for one specific gender, as it is difficult for the other gender. A recent report revealed Amazon's Artificial Intelligence (AI) recruiting technology[6] developed a bias against women because the training data fed during the development process of the technology, predominantly contained men's resumes, from their previous records. This technology revised applicants' resumes to identify the talented candidates according to the company's requirements. Also, this scenario established the fact that the tech industry is male dominant. Moreover, Face-Book dominates the job advertisements such as policy making to constructions only to male users. These type of biases are very common now-a-days. Previous research has also shown that softwares and websites are developed without considering both genders. In realization of the United Nation Millennium Development Goals intensive research has been carried out on gender issues and information communication technology, with focus on the challenges and prospects for women empowerment in Nigeria[8]. Women were regarded as an insignificant variable for drafting of the Information Communication Tech-

nology (ICT) policy, creating a prominent gender digital divide. To investigate the effect of this problem, data was gathered using questionnaires, and was analyzed using Statistical Package for Social Science, which revealed that, gender inclusiveness in policy drafting is crucial for socio-economic development, improved healthcare and women empowerment in Nigeria. This also reflects the fact, how gender inclusiveness in the field of ICT can lead to an impact in the overall economy of a nation and it applies for most nations.

Another research justifies the gender gap in computer and internet usage through literature review and Hofstede's model. It was found that, although information and communication technology has brought many changes in society in different aspects, and provided new challenges for human beings, women, comprising over half of society, are not waived of these changes [9], since they do not have the similar access or use of IT as males. Furthermore, there has also been research on how gender gap affects the education of children, with the use of technology. There are indications that the use of technology in education affects girls and boys differently. The empirical study focused on the relationship between the inclusiveness of educational tools and the learning experiences of girls and boys. The study revealed that, gender scripts are embedded in educational tools, which underpins the classroom practice and affect learner experiences[11]. Incorporating gender inclusiveness generates positivity towards learning and technology and enhances the classroom participation of both boys and girls.

In light of these discoveries, through years of research, work has been done in the United States of America(USA), to make tools and softwares [GenderMag[7]] more gender inclusive. GenderMag is a tool that was developed to help software practitioners evaluate their softwares for gender neutrality. After multiple-case field study of software teams at three major U.S. technology organizations, the usefulness of this tool was established. GenderMag identified approximately twenty-five percent of the software features to have gender inclusiveness issues. However, in Bangladesh, this aspect of User Experience(UX) design issue, is not known to be considered yet. Multiple research are carried out to evaluate usability of mostly university websites or e-government websites, but none on gender perspective. For instance, a research conducted in the University of Dhaka[13], using a survey instrument to gather students' views on their own university website. They emphasized on the question that, whether the students were able to find relevant information or not. It concluded with five factors that were relevant for achieving the optimal usability: interactivity and functionality, navigation, searching and interface attractiveness, accuracy of information, learn-ability and operable, efficiency and reliability. In addition to that, another research[14], addresses the issues affecting e-governance implementation in Bangladesh. From theoretical study, a structured questionnaire was created to gather quantitative data, which was analyzed to identify any implementation problems and deliver a clear presentation of it. With the aid of these findings, the issues could be rectified, or acknowledged while creating such a website. Due to this we conducted this investigation on the gender perspective, aiming to make sure that websites, which have proved to have essential uses, do not have biases, simply through analyzing the statistical figures comprising of: the score of information processing, self efficacy and willingness to tinker, between males and females, through

certain platforms. This directly relates to the sustainable development goals (SDG-05) gender equality and is the change required in the constantly growing IT sector of our country. Our methodology includes task forms to be completed by university students. The participants comprise of equal numbers of males and females. Selected tasks are assigned to them to perform from the selected educational and IT websites. Through screen recording and voice recording data collection is done, which is further analyzed, to derive scores of self-efficacy, information processing and tinkering. Eventually developing a statistical model to extract any gender inclusiveness issue, and subsequently modifying the user interface of the chosen websites to ensure its gender neutrality.

Chapter 3

Methodology and Design of Study

This investigation is carried out by observing some tasks performed by participants on selected websites. Participants were provided with task forms which was to be completed before and after the Observational Lab Study. The Task Forms contains some Standard Questions which were answered on a scale of, one-ten or from one-seven. To elaborate:

3.1 Task Design

The Pre-Task form: Contains some basic questions such as the student's age, computer experience in years, their degree major. We used the standard self-efficacy test questionnaire proposed by Compeau and Higgins[15], after slight modification to make it suitable with respect to the context of this investigation. Here are also questions that ask the user to indicate if they could use the unfamiliar website under various conditions mentioned. If the answer was 'yes', they had to rate their confidence. From this scale rating of one to ten, we derived self-efficacy score, which is the quantitative data. Here point one indicates 'Not at all Confident', point five/six indicates 'Moderately Confident' and point ten resembles 'Total Confidence'. Also, there is an open-ended question for finding the Tinkering Score, which is a qualitative data.

The Post-Task form: This also includes ten standard questions, which was seven-point likert scale type of questions.[16] We made slight modification to the questions to suit to this context. First five questions tests for comprehensive(systematic) information processing style, and the rest five tests for heuristic(selective) information processing style. In this scale, point one indicates 'Slightly', point four suggests 'Moderately' and point seven indicates 'Absolutely'. Finally, from this scale information processing score was derived.

The Manual: Contained instructions about the tasks they needed to carry out on the websites, but the participants were not told explicitly how to do it. They were given the freedom to explore on their own or, spend as much time as they thought was necessary for each task. The information collected using the task forms were relevant factors that affected the participants' performance on the websites and enabled us to differentiate between the genders. In addition to that, during the study OBS screen recorder was used to record the monitor screen while the students were

working on the websites. Also, audio recordings were collected using smart-phones, since the participants were expected to follow Think Aloud protocol to provide a walk-through of their experiences while carrying out the activity.
We carried out two separate investigations, one was the Pilot study comprising of three male and three female participants. Then, we carried out the final investigation on total fourteen students, seven of each gender. The manual we used during our pilot study was not very reflecting on the results, which is why it was modified for use in the final study. The pilot study also helped with the modification of the question structure in the pre-task and post-task forms.

The task manual that was used during the pilot study was:
• GrameenPhone (www.grameenphone.com):
1. Find out how to activate roaming in a grameenphone number.
2. Find the option for providing customer review.
• BRAC University(www.bracu.ac.bd):
1. Plan a course outline selecting suitable courses for your next three semesters.
2. Find out the necessary details about changing department.

More relevant tasks were added during the final study, which are the useful information on the websites.
The specific tasks that were given during the final empirical study were:
GrameenPhone (www.grameenphone.com):
1. Find forms which you need to activate roaming on your SIM.
2. Where can you provide customer review?
3. Steps of getting M2M (machine to machine) plan (to connect devices over GP network)
4. GP has a vehicle tracking service which also has insurance benefits. Suppose, you need to use this service, find the insurance claim form.

BRAC University(www.bracu.ac.bd):
1. Plan a course outline for next two semesters
2. Find necessary details for changing department
3. Find information about the IT workforce head at BRAC University.
4. Suppose you want to contribute to the BRACU newspaper, find the article submission form.

The following four tasks on each website were selected by searching the websites for common and useful information that can be found, but apparently required more time than it should. As of now, we worked on two categories of websites: Educational and IT company.

3.2 How and Where

We had two sets of participants:
1.Novice- Students of first and second year from BRAC university from different departments, such as, Computer Science, Business, Economics, Mathematics Natural Sciences.
2. Expert- Students of third and fourth year.

We had access to a computer laboratory in our university to carry out the study with the students as participants. There were four or five students at a time, since it was difficult to adjust to their different schedules. Moreover, each set of participants (novice and expert), included equal number of males and females, so that the outcome could be unbiased. Total fourteen students participated, each of whom performed the specific set of tasks on the websites, of the two categories mentioned.

3.3 Participants

Within our selection criteria were both students with little experience(novice), and students with somewhat good experience(expert) on the test websites. Also, students from other than the IT departments were also selected, otherwise they might have an added advantage of more experience. This is because the Engineering students are more likely to tinker with websites and or softwares. For recruiting participants, the approach was visiting different departments, and through social media invitations. They were also provided with remuneration for investing their time to our empirical study. The novice students took about thirty to forty-five minutes to complete the entire study, whereas, not-novice students required approximately fifteen to twenty minutes.
Below is an overview of the participants' demographic:

Participant ID	Gender	Age	Degree Major	Computer Experience(years)
M01	Male	22	CSE	10
M02	Male	22	CSE	10
M03	Male	20	CSE	5
M04	Male	24	BBA	15
M05	Male	21	CSE	6
M06	Male	23	BBA	2
M07	Male	20	CSE	12
F01	Female	21	BBA	10
F02	Female	19	CSE	4
F03	Female	21	CSE	2
F04	Female	21	BBA	2
F05	Female	23	EEE	10
F06	Female	21	BBA	0
F07	Female	22	BBA	5

Table 3.1: Participant Demographic

3.4 Data Collection

The computers used by participants, were installed with OBS Screen Recorder. The video clips during the study were collected. Voice recordings were also collected as they followed Think Aloud Protocol, to understand their different perspectives. Such as, whether they were facing any difficulties, or were easily able to perform the tasks. In the result section, we have added most frequently used quotes by

the participants. For voice recording smartphones were used. The Pre-Task and Post-Task forms were also the part of the data collection.

3.5 Analysis of Data

From the screen video record and the voice record, values were assigned as number of successes, errors, approaches or failure. When a task was completed correctly, it was counted as a success; error count was the number of times incorrect links were selected for a given task. The approach was the number of times and the different ways a student attempted to complete a given task, and failure was counted when the task was not completed. Also, the time taken to complete the tasks in each website was taken into account, which suggested how easy or difficult it was for the individual to navigate. All these attributes were accounted for each task on each website. Furthermore, the Task forms enabled us to measure the self-efficacy, information processing and tinkering scores separately for male and female participants.

3.6 Code Set and Rules

The results obtained were converted to a .csv format file, and used as an input to carry out statistical analysis using R language and its tools. The output statistical model provided a graphical representation of the scores and our findings. The table contained the respective participant ID and their corresponding gender, self-efficacy scores, tinkering scores, comprehensive and heuristic information processing scores, time taken and number of approach. Also, each of the four task scores on the two websites. The snip of this table is given in the appendix section. Moreover, from the expressions and the comments of the participants during the study, we could find the limitations, or areas of improvement on the websites' User Interface (UI).

The algorithm includes:
1. Box plot for comparing the self-efficacy scores of males and females.
2. The linear regression line plot of Task Score versus Self-efficacy.
3. Multi-variation of the models using ANOVA test and Fisher Exact Tests, to find Tinkering and Information Processing.
4. Correlations of Tinkering and Time Taken to complete tasks using Spearman and Pearson's method.
5. Correlation between Information Processing Style and Task success using Spearman and Pearson's method.

Chapter 4

Data Analysis

To start with, a pilot study including six participants were conducted. Three of them were males and the rest three of them were females. The pilot study was basically for testing whether, our selection of tasks on the websites and the task forms were appropriate and relevant. Prior to running the pilot study, we have explored the two websites to select some features that could be useful, but was possibly inconvenient for users. As mentioned before, the self-efficacy(Pre-task form) and information processing(Post-task form) and the tinkering scores were found from the answers to the questions in the task forms. The options for the answers were in a rating format and for information processing there were both selective and comprehensive type scores. Also, from the answer to the open-ended questions, words were mapped to values for tinkering score.

4.1 Pilot Study

Participant ID, Department/Year	Website	Success(percent)	Error no.	Approach	Time(seconds)
M01, CSE/4th	BRACU	90	1	8	305
	GP	95	1	5	171
	BDjobs	90	1	5	214
M02, ESS/4th	BRACU	100	1	8	356
	GP	95	1	5	125
	BDjobs	95	1	3	163
M03, BBA/2nd	BRACU	80	2	6	470
	GP	40	3	5	309
	BDjobs	50	1	3	260
F01, Pharmacy/2nd	BRACU	40	5	10	620
	GP	80	1	3	155
	BDjobs	50	2	4	546
F02, Pharmacy/2nd	BRACU	80	2	5	539
	GP	40	0	1	52
	BDjobs	0	3	4	540
F03, ENH/2nd	BRACU	75	2	3	380
	GP	50	3	6	309
	BDjobs	100	4	9	338

Table 4.1: Summary of results of Pilot Study

To summarize:
Among the three males (M01, M02, M03) and three females (F01, F02, F03),
1. Average success rate for tasks in all three websites is, male: 82.2 percent, female: 57.2 percent.
2. Average number of errors is, male: 2 errors per task, female: 3 errors per task.
3. Average number of approaches taken for each task are 6 for both males and females.
4. Average time taken for each task, male: 4 minutes, female: 6 minutes.
However, there were differences due to the duration of computer experience (in years) of these participants. Also, the factors like, educational background, age, current department and semester affected their performance, which was difficult to reflect.

4.2 Final Study

During the final study including fourteen participants, we took both novice and expert users.

Males (out of 100)	Females (out of 100)
73	56
72	66
79	69
79	52
81	54
78	64
74	62
Total: 536	Total: 423
Average: 76.57	Average: 60.43

Table 4.2: Results from Pre-Task form, Self-Efficacy scores.

Summary of Data			
Values	Treatment 1	Treatment 2	Total
N	7	7	14
Summation of X	536	423	959
Mean	76.5714	60.4286	68.5
Summation X^2	41116	25813	66929
SD	3.5051	6.4771	9.7567 height

Result Details				
Source	SS	df	MS	F
Between Treatments	912.0714	1	912.0714	33.63213
Within Treatments	325.4286	12	27.119	
Total	1237.5	13		

Table 4.3: The Mean and Standard Deviation (SD) of Self-Efficacy scores according to the sample size, using ANOVA calculator.

The f-ratio value is 33.63213. The p-value is 0.000085. The result is significant at p less than 0.01

	Grameenphone		BRAC University	
	Average Completion	Average time (minutes)	Average Completion	Average time (minutes)
Male	71.4%	7.28	60.7%	9.14
Female	42.9%	9.86	46.4%	10.14
Male: Female	10: 6	10: 7.4	10: 7.6	10: 9

Figure 4.1: Averages of the task performances.

Quotes of Participants:
“ Search does not recognize whatever I am typing ”
“ Finding information from the BRACU website was more difficult ”
“ I generally don’t like to play with new softwares because I am not interested in doing so ”
“While using new software there will be lots of new things to learn which will help me for future use. ”

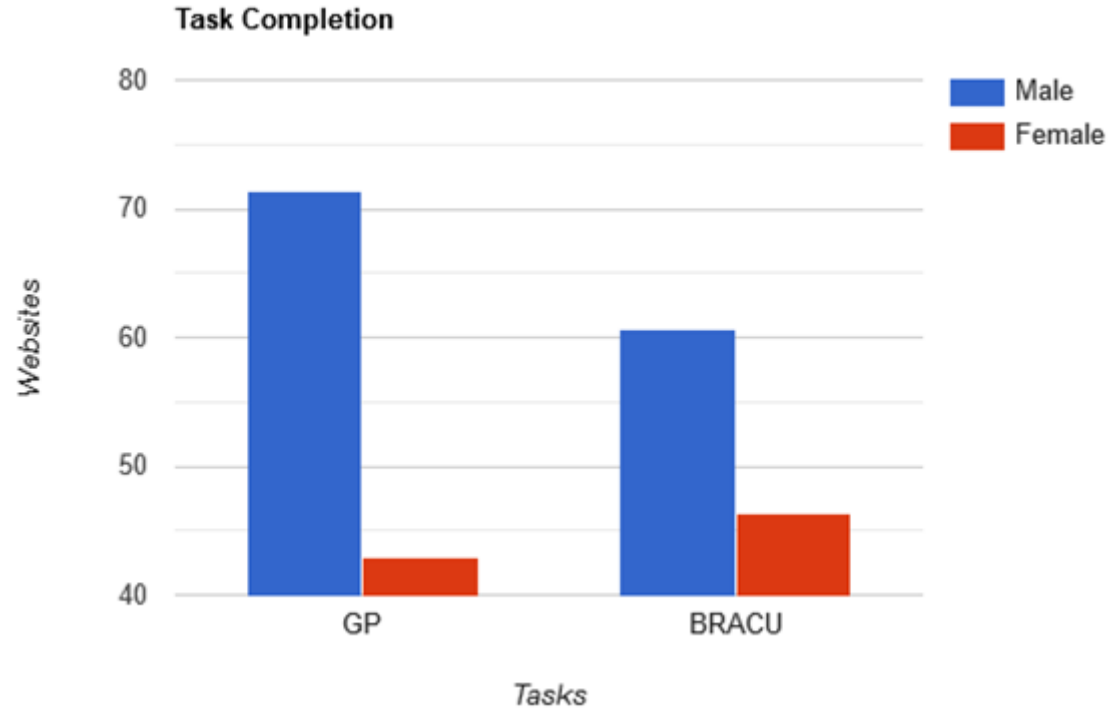

Figure 4.2: A graphical representation of the percentage of task completion of both genders, with respect to the websites.

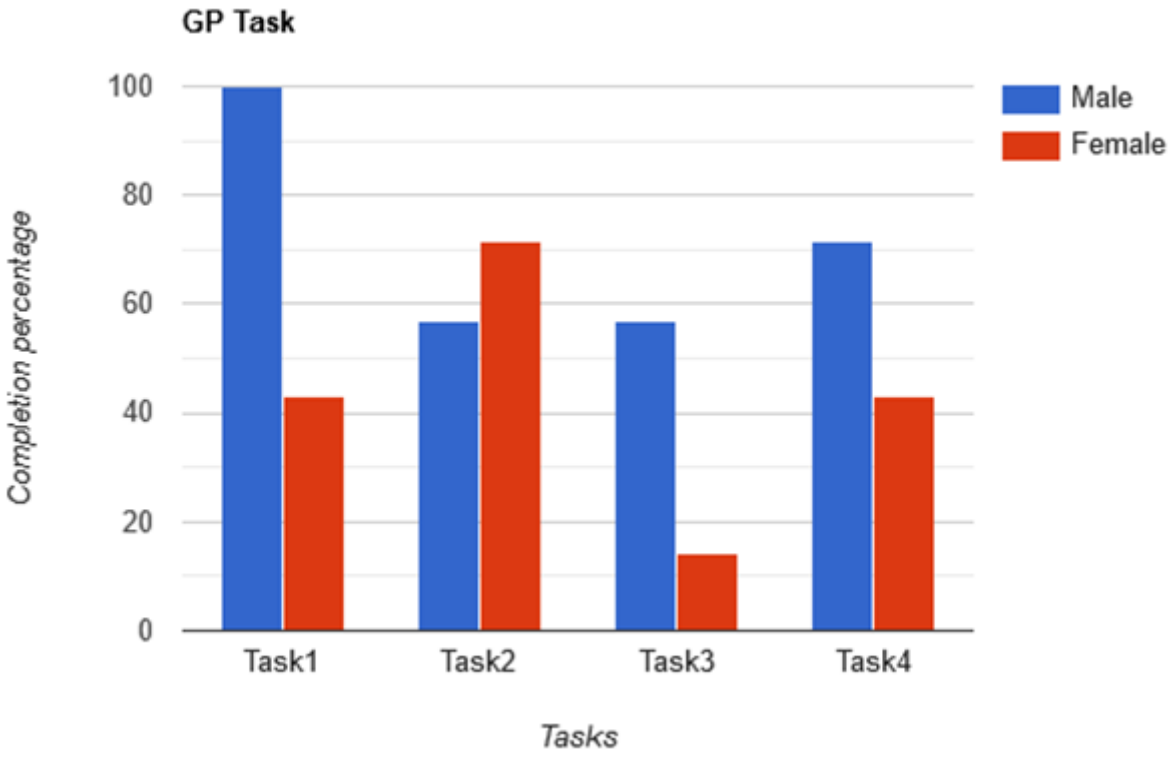

Figure 4.3: A graphical breakdown of Completion Percentage of each Task using GrameenPhone website.

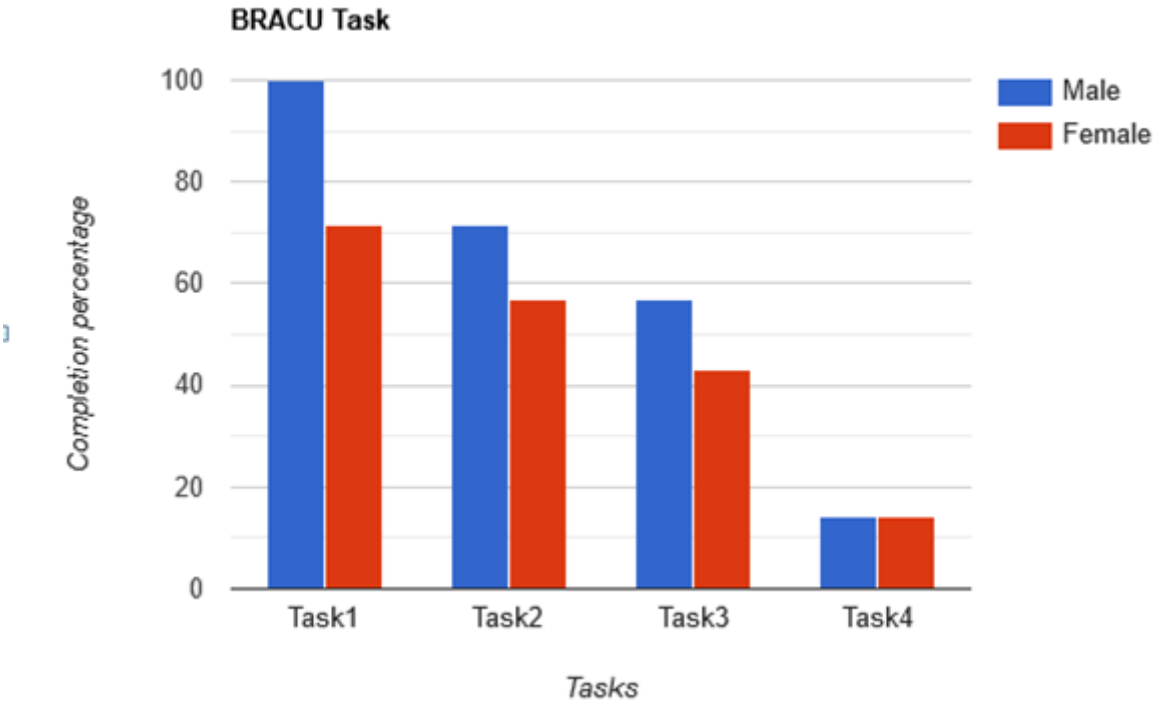

Figure 4.4: A graphical breakdown of Completion Percentage of each Task using BRAC university website.

Calculation

Pooled Variance

$s^2_p = ((df_1)(s^2_1) + (df_2)(s^2_2)) / (df_1 + df_2) =$
325.43 / 12 = 27.12

Standard Error

$s_{(M_1 - M_2)} = \sqrt{((s^2_p/n_1) + (s^2_p/n_2))} = \sqrt{((27.12/7) +}$
(27.12/7)) = 2.78

Confidence Interval

$\mu_1 - \mu_2 = (M_1 - M_2) \pm ts_{(M_1 - M_2)} = 70.1428 \pm$
(1.78 * 2.78) = 70.1428 ± 4.961155

Figure 4.5: The result of Independent Samples using Confidence Interval Calculator. The above data generates an interval estimate of the difference between two population Means. It can be said with 90 percent confidence that, the difference between the two population Means lies between 65.181645 and 75.103955.

Figure 4.6: The box-plot representation of Self-Efficacy scores.

Male	Female
0	1
0	1
0	0
1	1
1	0
0	0
1	1
Total- 3	Total- 4

1 represents "Yes, participant likes to explore new software."

0 represents"No, participant doesn't like to explore new software."

Figure 4.7: Binary values that represent the likelihood of Tinkering.

Results			
	Males	Females	***Marginal Row Totals***
GP	111	99	210
BRACu	203	133	336
Marginal Column Totals	314	232	546 (Grand Total)

The Fisher exact test statistic value is 0.0911. The result is *not* significant at p < .05.

Figure 4.8: The result of Tinkering using Fisher Exact Test Calculator. This is a notable difference between the Tinkering of males and females since the P-value 0.0911 is greater than 0.05.

Success! The Fisher exact test statistic and statement of significance appear beneath the table. Blue means you're dealing with dependent variables; red, independent.

Results			
	Comprehensive	Selective	***Marginal Row Totals***
males	32	30	62
females	28	21	49
Marginal Column Totals	60	51	111 (Grand Total)

The Fisher exact test statistic value is 0.5721. The result is *not* significant at p < .05.

Figure 4.9: The Comprehensive and Selective scores of both the genders in the Fisher Exact Test. P-value equals 0.5721.

Chapter 5

Results of Linear regression and Correlation

The significant findings among other results are listed here:

1. Task score on Grameenphone website versus Self-efficacy have a significant positive Correlation
Pearson: 0.5470108

Spearman's rank correlation rho S = 196.72, p-value = 0.03423
Alternative hypothesis: true rho is not equal to 0
Sample estimates: rho 0.5676426

2. Residuals of Linear Regression:

Minimum	-1.62182
Lower Quartile	-0.52636
Median	-0.03455
Upper Quartile	0.62182
Maximum	1.38909 height

Residual standard error: 0.9042 on 12 degrees of freedom
Multiple R-squared: 0.2992,
Adjusted R-squared: 0.2408
F-statistic: 5.124 on 1 and 12 DF,
p-value: 0.04293

3. Time taken to complete tasks on BRAC University website versus Tinkering has a negative Correlation. The more the participants tinkered, the less time they needed.
Pearson: [1] -0.7291634

Spearman's rank correlation rho S = 783, p-value = 0.003625
Alternative hypothesis: true rho is not equal to 0
Sample estimates: rho -0.7208837

4. Task scores on BRAC University versus Selective information Processing: Significant p-value implies users task success were influenced by selective processing, reflecting a positive Correlation
Pearson: 0.6583653

Spearman's rank correlation rho: S = 148.79, p-value = 0.008345
Alternative hypothesis: true rho is not equal to 0
Sample estimates: rho 0.6729932

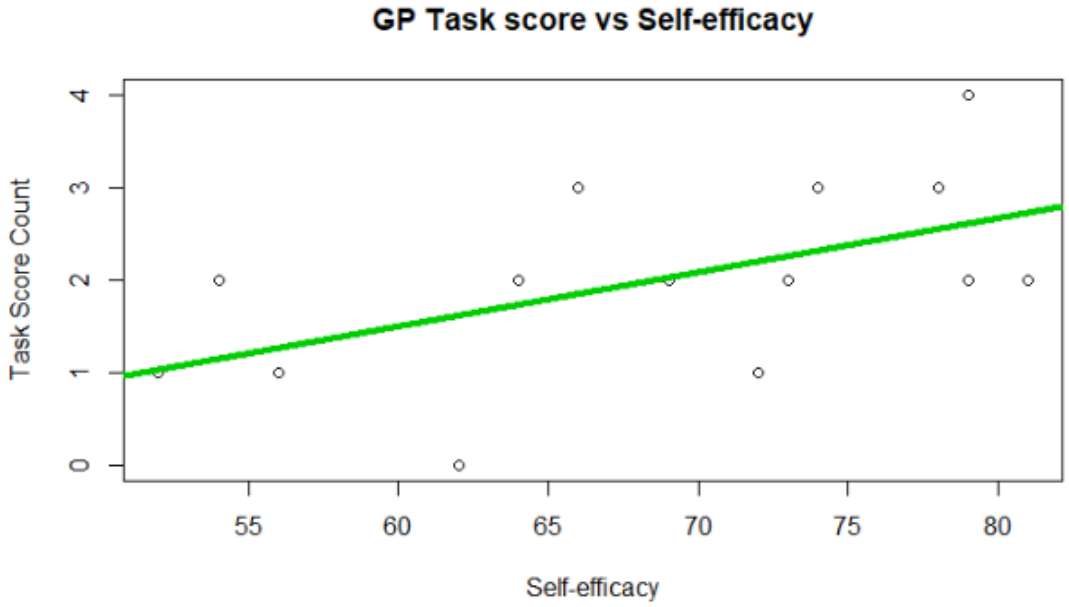

Figure 5.1: Linear regression showing positive correlation between Task Score and Self-efficacy score, GP website.

Chapter 6

Conclusion and Future Works

In this section, we will conclude our findings through this empirical investigation, from the qualitative and quantitative analysis of the dataset collected.

6.1 Answer to RQ1:

We found that the self-efficacy of males is greater than that of females in computing settings. This is evident from the self-efficacy score, which is 77 out of 100 for males and 60 out of 100 for females.

6.2 Answer to RQ2:

The Fisher Exact Test result suggests a notable difference between the Tinkering of males and females since the P-value 0.0911 is greater than 0.05.

6.3 Answer to RQ3:

There is a slight difference between the information processing strategies of both the genders, it is indicated by the P-value that equals to 0.5721. Although, both males and females comprehensive processing scores are greater than selective or heuristic processing scores, the values are different for each gender. For males it is 32 out of 35 and for females it is 28 out of 35. Therefore from this investigation and the selected demographic, it cannot be verified that males are heuristic processors and females are comprehensive processors.

6.4 Limitations of this Investigation:

Limited number of participants:
This research was conducted with a limited number of participants. This is due to difficulty in managing the different time and schedule of the students, and the time consuming nature of the study. During our pilot study we found some major differences in the performance of a fourth year and a second year student. Which is why later in our final study, we selected students ranging from first to fourth year to

consider the changes for different ages. However, the age gap is still not much diverse.

Multiple Factors affecting performance on websites: On the other hand, there are other factors that affect the usability of websites such as, linguistic and professional diversities, comprehensibility of the information on the websites, or how much computer experience a person has. Such factors were not accounted for in our study.

Possible Inappropriateness of Questions: In any case, these general tasks may not be as suitable for every one of the participants as they ought to be. The difficulty level may vary from student to student affecting their performance and hence the results.

6.5 Future Works:

Evidently, it is significant that we address the issue of gender biasness and work towards eliminating it from computing settings. We plan to further expand this investigation to a more diverse demographics and other different categories of websites, with greater number of participants. This can make our Statistical model more reliable and accurate. Based on the findings, we plan to make some front-end modifications using HTML, CSS and JavaScript. Before that, the website owners would be formally informed and consulted, to come up with a front-end layout that can effectively bring about a better User Experience and unbiasedness for both genders. In addition to that, gender biasness evaluation should be carried out with some softwares that are used commonly for work related purposes such as Microsoft Office. With effective design considerations we can modify the user interfaces and enhance the User Experience .

Bibliography

[1] Nicole M. Else-Quest, Janet Shibley Hyde, Marcia C. Linn, "Cross-national patterns of gender differences in mathematics: A meta-analysis.", Psychological Bulletin 136(1), 103-127, 2010.

[2] Patricia Cafferata and Alice Tybout, "Gender Differences in Information Processing: A Selectivity Interpretation, Cognitive and Affective Responses to Advertising.", Lexington Books, 1989.

[3] Kathleen Hartzel, "How self-efficacy and gender issues affect software adoption and use.", Communications ACM 46, ACM, 167-171, 2003.

[4] Jill Cao, Kyle Rector, Thomas Park, Scott Fleming, Margaret Burnett, and Susan
Wiedenbeck, "A debugging perspective on end-user mashup programming.", In Proceedings
IEEE Visual Languages and Human-Centric Computing, IEEE, 149-156, 2010.

[5]Janne Chung, Gary Monroe, "Gender Differences in Information Processing: An Empirical Test of the Hypothesis-Confirming Strategy in an Audit Context." Wiley Online Library, 2002.

[6] Brian Snyder, Reuters, "Amazon ditched AI recruiting tool that Favored Men for
Technical Jobs," The Guardian, Technology, October. 2018.

[7]Margaret Burnett, Anicia Peters, Charles Hill, Noha Elarief, "Finding Gender-Inclusiveness Software Issues with GenderMag: A Field Investigation.", Oregon State
University, USA, 2016.

[8]Kwetishe Joro Danjuma, Bayo Mohammed, and Ochedikwu Jonah Onche, "Gender Issues
Information Communication Technology for Development (ICT4D): Prospects and Challenges for Women in Nigeria.", Research Gate, April 17, 2015.

[9]Golnessa Galyani Moghaddam, "Information technology and gender gap: toward a
global view.", The Electronic Library, Vol. 28 Issue: 5, pp.722-733, 2010.

[10]Derrick Barth, “Designing the Gender-Neutral User Experience.”, Worcestor Polytechnic Institute, 2012.

[11]Irma Heemskerk, Geert ten Dam, Monique Volman, Wilfried Admiraal, ”Gender Inclusiveness in Education Technology and Learning Experiences of Girls and Boys.”, Journal of Research on Technology in Education, Volume 41, Issue-3, 2009.

[12] Lamers M.H, Verbeek F.J, van der Putten P.W.H, ”Tinkering in scientific education.”, In: Reidsma D., Ktayose H., Nijholt A. (eds), Advances in Computer Entertainment, ACE, 2013.

[13] Md. Shamsur Rahman, SM Zabed Ahmed, ” Exploring the factors influencing the usability of academic websites: A case study in a university setting.”, Business Information Review, Vol.30, issue:1, 2013.

[14] Hasan Shahid Ferdous, Farhana Murtaza Choudhury, ”Usability Analysis of e-Governance Services in Bangladesh- A survey and future directions.”, 15th International Conference on Computer and Information Technology(ICCIT), INSPEC Accession number:13503024, 2012.

[15]Deborah R Compeau and Christopher A Higgins, ”Computer self-efficacy: Development of a measure and initial test.”, MIS quarterly, 1995.

Appendix

Pre-task form

Please write down the following information:

Age	
Gender	
Degree major	
Computer experience in years	

Often in our jobs we are told to use hardware that are available to make our work easier. For the following questions, imagine that you were given a website for some aspect of your work. It doesn't matter specifically what this website does, only that it is intended to make your job easier and that you have never used it before.
The following questions ask you to indicate whether you could use this unfamiliar website under a variety of conditions. For each of the conditions, please indicate whether you think you would be able to complete the job using the website. Then, for each condition that you answered "yes," please rate your confidence about your first judgment, by highlighting a number from 1 to 10, where 1 indicates "Not at all confident," 5 indicates "Moderately confident," and 10 indicates "Totally confident."

Figure 6.1

I could complete the task …

No.	Question	Not at all confident			Moderately confident					Totally confident
Q-1	...if there was no one around to tell me what to do as I go	YES…1 NO	2	3	4	5	6	7	8	9 10
Q-2	...if I had never used a website like this before	YES…1 NO	2	3	4	5	6	7	8	9 10
Q-3	...if I only had the website manual for reference	YES…1 NO	2	3	4	5	6	7	8	9 10
Q-4	...if I had seen someone else using it before trying it myself	YES…1 NO	2	3	4	5	6	7	8	9 10
Q-5	...if I could call someone for help if I got stuck	YES…1 NO	2	3	4	5	6	7	8	9 10
Q-6	...if someone else had helped me get started	YES…1 NO	2	3	4	5	6	7	8	9 10
Q-7	...if I had a lot of time to complete	YES…1 NO	2	3	4	5	6	7	8	9 10

Figure 6.2

	the task										
Q-8	...if I just had the website's built in help facility to get started	YES...1 NO	2	3	4	5	6	7	8	9	10
Q-9	...if someone showed me how to do it first	YES...1 NO	2	3	4	5	6	7	8	9	10
Q-10	...if I had used similar website before this one, to do the same task	YES...1 NO	2	3	4	5	6	7	8	9	10

Please answer the following question:

Q1. How often do you play with a new software? Why or why not?

Figure 6.3: The Pre Task form, completed before the starting with the websites

Hello, these are some tasks that you can complete using the given websites only. The purpose here is to test how useful these websites are and we can find that out from how you are completing or attempting to complete these tasks. There is no fixed time for you to spend on these websites. It is completely up to you how much time you will spend to complete the given tasks (3 tasks for each website), in case you face any difficulties. Also, try to think out loud while you proceed so that we can understand whether you are facing any difficulties or you can find everything with ease. You can also tell if you cannot find a particular information and want to quit the task.

GP (www.grameenphone.com):

1. Find forms which you need to activate roaming on your SIM.

2. Where can you provide customer review?

3. Steps of getting M2M (machine to machine) plan (to connect devices over GP network).

4. GP has a vehicle tracking service which also has insurance benefits. Suppose, you need to use this service, find the insurance claim form.

BRAC (www.bracu.ac.bd):

1. Plan a course outline for next two semesters.

2. Find necessary details for changing department.

3. Find information about the IT workforce head at BRAC University.

4. Suppose you want to contribute to the BRACU newspaper, find the article submission form.

Figure 6.4: The tasks performed by the participants

Post-task form

Now that you have used the website to complete given tasks please answer the following questions. Your answer should be based on your experience with the website provided, on how you used the website. For each condition that you answered "yes," please rate about your first judgment, by circling a number from 1 to 7, where 1 indicates "Slightly," 4 indicates "Moderately," and 7 indicates "Absolutely." If the answer is no, just highlight “no” and rating is not needed.

Figure 6.5

No.	Items	Slightly			Moderately			Absolutely
Q-1	I thought about what actions I might take, based on the given task manual.	YES… 1 NO	2	3	4	5	6	7
Q-2	I could make connections between the information given and the knowledge that I already have.	YES… 1 NO	2	3	4	5	6	7
Q-3	I thought about how the information in the websites related to other things I know.	YES… 1 NO	2	3	4	5	6	7
Q-4	I tried to think about the importance of the information.	YES… 1 NO	2	3	4	5	6	7
Q-5	I tried to relate my task with the ideas in the given information.	YES… 1 NO	2	3	4	5	6	7
Q-6	I skimmed through the information on the websites.	YES… 1 NO	2	3	4	5	6	7
Q-7	I did not spend much time thinking about the given information.	YES… 1 NO	2	3	4	5	6	7

Figure 6.6

Q-8	The given manual did not contain useful information on which I based my decision.	YES… 1 NO	2	3	4	5	6	7
Q-9	While reading the information I did not think about the instructions presented in the manual.	YES… 1 NO	2	3	4	5	6	7
Q-10	The information contained too many incompatible viewpoints	YES… 1 NO	2	3	4	5	6	7

Figure 6.7: The Post-task form that was completed after the participants were done with the website tasks.


12:28 AM
https://www.bracu.ac.bd
MENU
Mission
Leadership and Management
Affiliations
HR and Administrative Policies
Career at BracU
The Vice Chancellor
Former Vice Chancellors
Brac University New City Campus
Institutes and Schools
Departments
Centres and Initiatives
Office of the Registrar
Fees and Payment
Programs
Policies and Procedures
Residential Campus
Institutional Quality Assurance Cell (IQAC)
Teaching and Research
News & Events
Resources
Ayesha Abed
Campus Life
Cafeteria

Figure 6.8

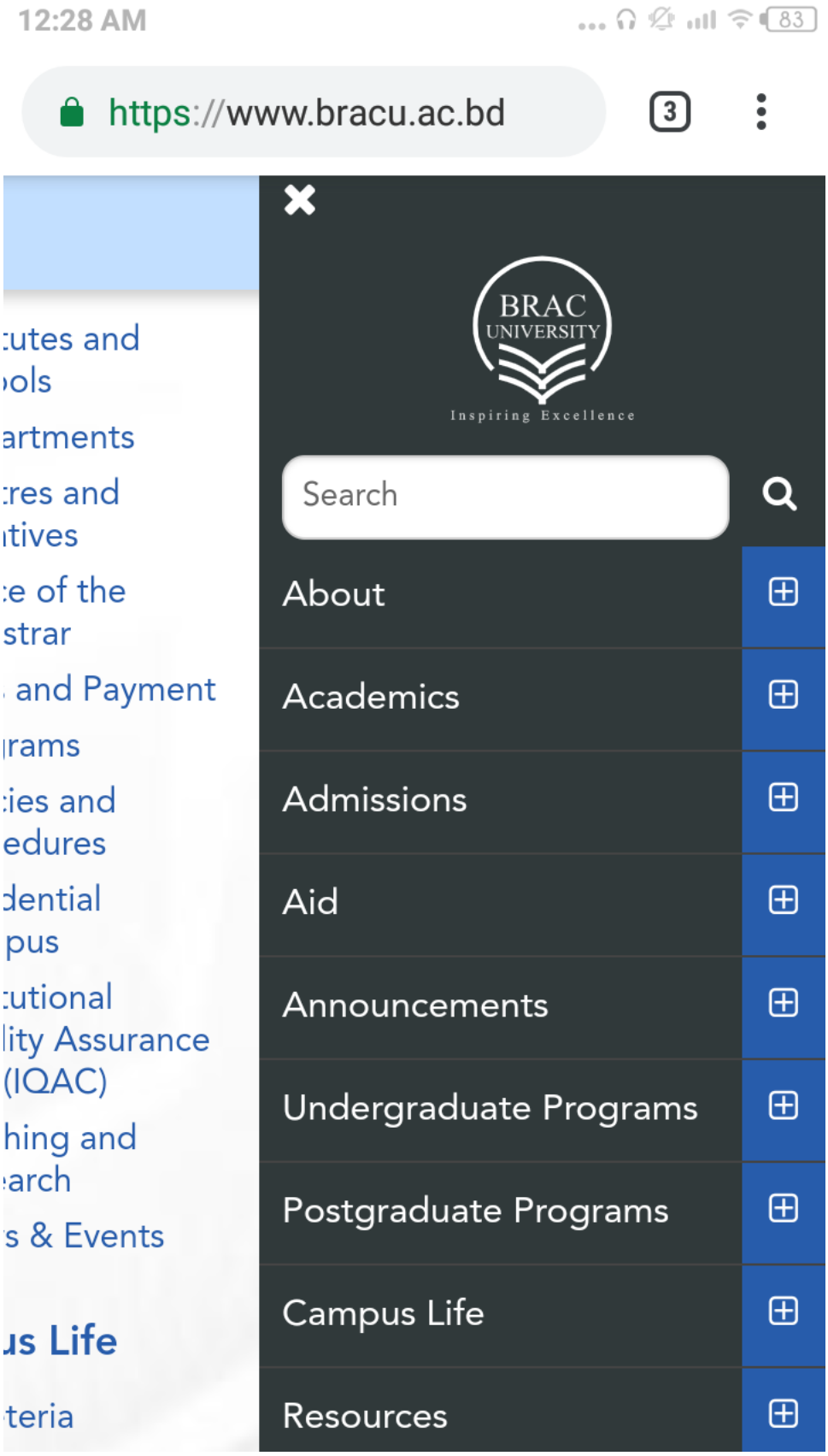

Figure 6.9: BRAC University website

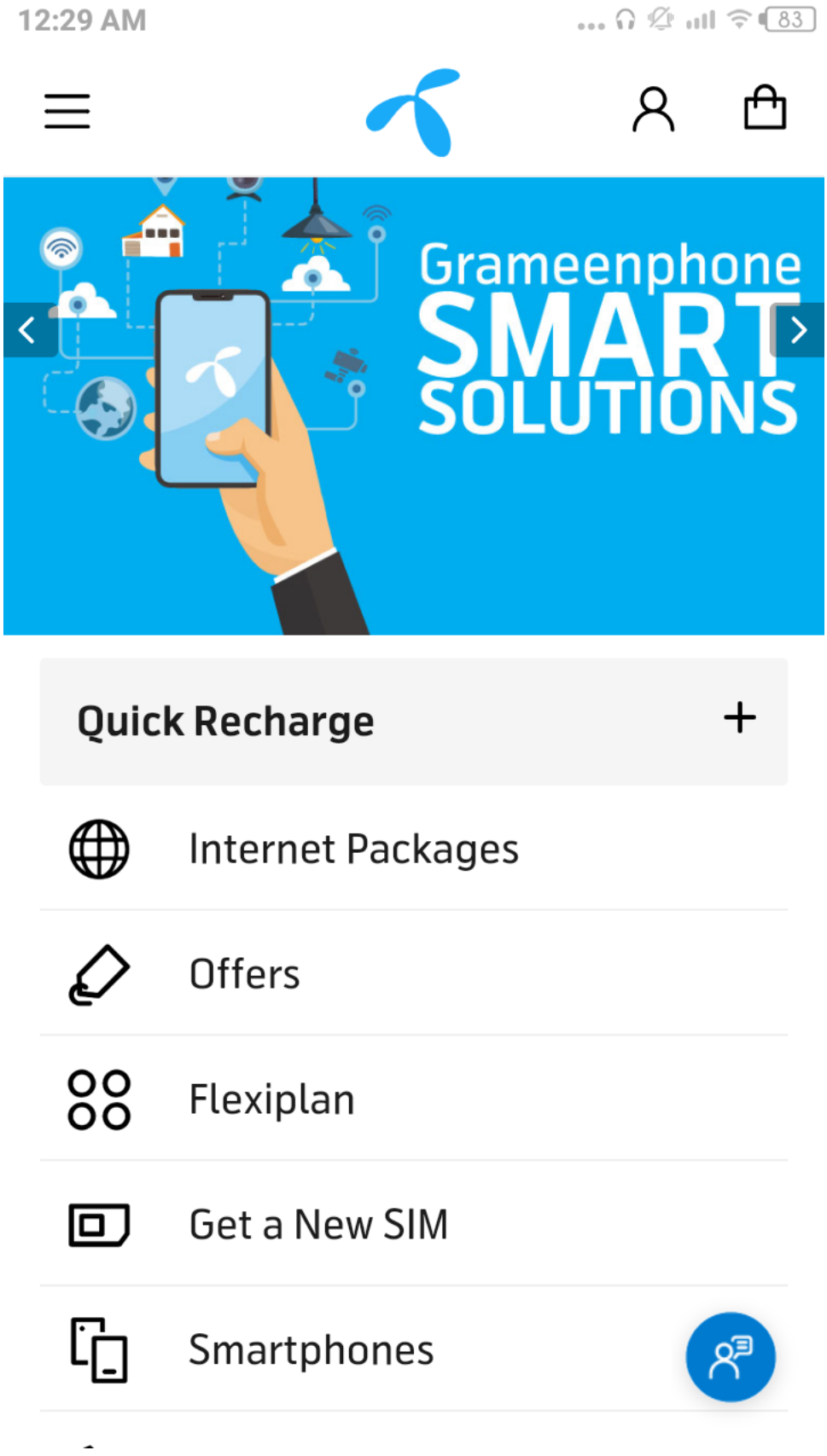
12:29 AM
83
Grameenphone
SMART
SOLUTIONS
Quick Recharge
Internet Packages
Offers
Flexiplan
Get a New SIM
Smartphones

Figure 6.10

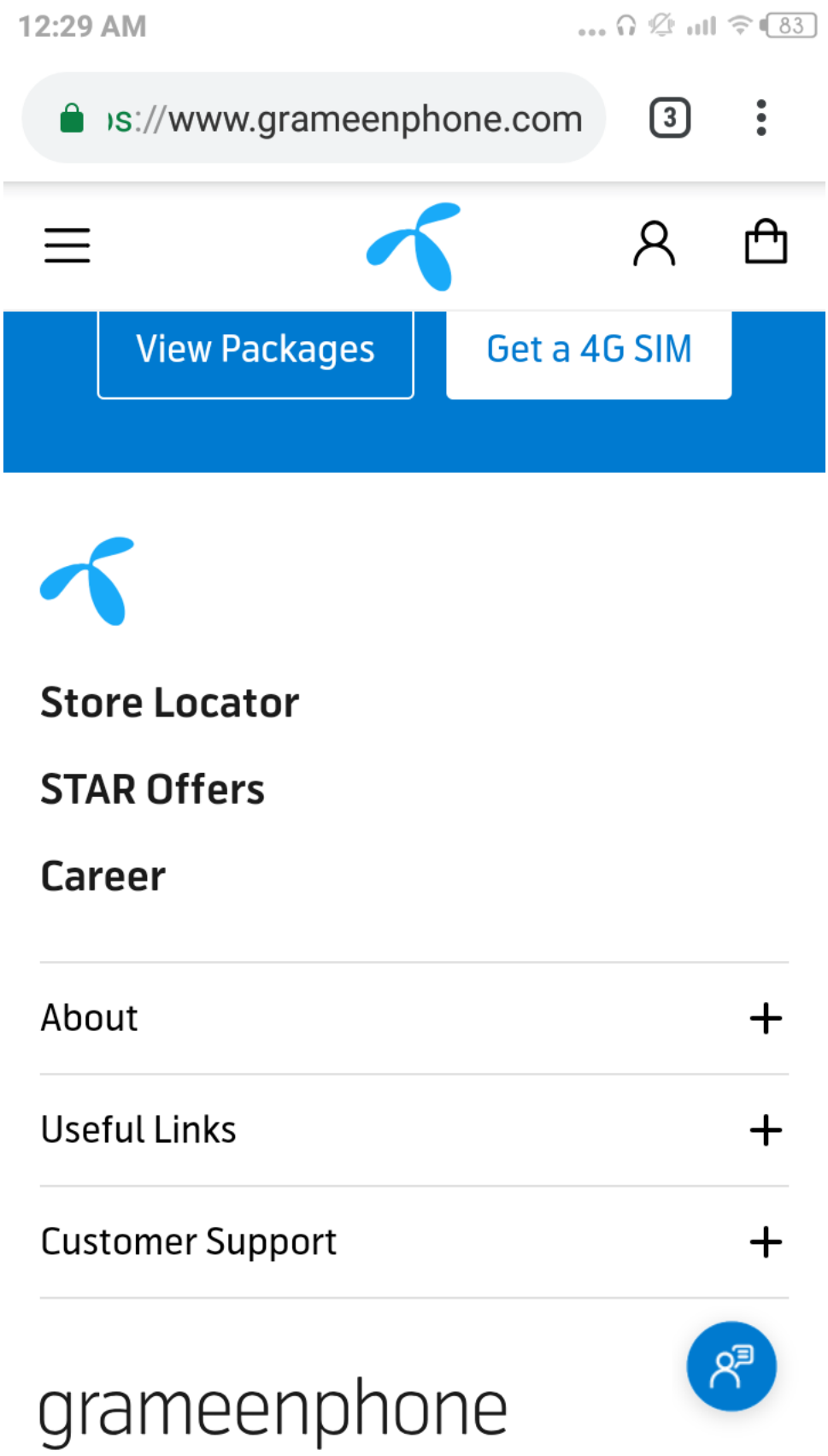

Figure 6.11: GrameenPhone website

ID	Gender	Self-Efficacy	Tinkering	Comprehensive Score	Selective Score	BU task score(out of 4)	GP task score(out of 4)	Time taken BU	Time taken GP	Computer experience(yrs)	click_BU	click_GP
P01	Male	73	1	4	4	3	2	300	240	10	24	16
P02	Male	72	1	4	4	3	1	360	480	10	29	16
P03	Male	79	1	4	5	4	2	420	660	5	10	16
P04	Male	79	0	6	6	3	4	840	300	15	43	21
P05	Male	81	0	5	3	2	2	720	420	6	34	11
P06	Male	78	1	5	4	3	3	360	240	2	30	13
P07	Male	74	0	4	5	3	3	840	720	12	33	18
P08	Female	56	1	3	1	1	1	600	600	10	14	11
P09	Female	66	0	5	3	2	3	660	600	4	25	20
P10	Female	69	1	5	4	2	2	780	720	2	16	17
P11	Female	52	0	2	6	3	1	900	960	2	18	16
P12	Female	54	0	3	4	2	2	540	300	10	23	15
P13	Female	64	1	6	2	3	2	420	600	0	23	10
P14	Female	62	1	5	1	2	0	360	360	5	14	10

Figure 6.12: The .csv formatted file imported to the R source code, containing the collected data and scores of each participant.