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An Empirical Analysis of Malaysian Pre-university Students' ICT Competency Gender Differences

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Abstract

Network and Mobile technologies industries have been the fastest growing industries in the World including Malaysia. The Malaysian government has given due emphasis on network and mobile technologies with the conceptualization of the MSC and other ICT initiatives in order to steer our country towards a high-income and knowledge-based society as well as achieving the status of a developed nation as stated in the Vision 2020. Nevertheless, the lack of competent ICT personnel has been the main obstacle that needs to be addressed immediately in order to alleviate the problem of providing the necessary human capital required by the network and mobile industries. The most effective way to uplift the number of ICT savvy personnel would be through ICT education in order to upgrade their ICT competencies. The issues of gender differences in terms of ICT competencies have been widely studied especially in the Western countries. This paper attempts to provide a different perspective in that it fills in the gap of lack of information pertaining to the Malaysian pre university students' ICT competencies. The findings from this study may lead to implications to the teaching and learning of ICT subjects as well as their evaluation and assessment in Malaysia. The utmost end result would be the emergence of more ICT savvy personnel who may contribute to the development of the network and mobile technologies sector in Malaysia.

Key words: Mobile Technologies, Gender Differences, ICT Competency, Pre University, Malaysia

1 Introduction

The growth of mobile or cellular penetration rate has skyrocketted since the invention of mobile phone and advancements in mobile network technologies. According to [36], the cellular penetration rate for developing world is expected to reach 68 percent at the end of 2010, mostly driven by the Asia and Pacific region whereby India and China alone are expected to contribute over 300 million mobile subscriptions in 2010. By the end of 2010, it is forecasted that there will be 5.3 billion cellular subscriptions worldwide with 940 million subscriptions of 3G services. In fact, 3G services have enabled users to enjoy fast data transmission, high-resolution video and multimedia services while travelling [7]. This surely shows that the growth of ICTs has given a drastic impact on our modern society [62].

Nowadays, mobile networks can be accessed by 90 percent of the world population and 80 percent of the population living in rural areas [36]. This paper will try to study the issue of lack of ICT personnel in providing the necessary workforce that is required urgently by the network and mobile industries in Malaysia. Since the foundation for a ICT literated human capital is through education, it is most proper that a study on the ICT competencies among students be conducted in order to further investigate whether there are gender differences among the pre university students as they are the future of the ICT workforce in Malaysia.

ICT competencies play an important role in developing a nation. [34] pointed out that knowledge; skills and confidence with computer technology are assets for those who want to enter into the competitive employment market. Furthermore, with the increasing use of ICT in education all over the world, new skills and competencies among students are necessary for them to learn effectively. Besides that, [69] stressed that students who did not have access to computers and the Internet technology were likely to get further behind their peers who did have such access. [2] further emphasized that they would potentially miss out the 70 percent of jobs which require moderate or high level of computer knowledge and eventually ended up in the 10 percent low-pay jobs that do not require technical knowledge. Although students have greater access to PCs and the Internet than ever before [30], there is increasing assumption that the computer literacy training provided by tertiary institution has become redundant [51]. But as mentioned by [2] p. 61, “with the increased use of ICT in society in general and schools in particular, it becomes imperative that students should be equipped with digital literacy competencies in order to exploit information resources that the electronic age engenders.” School leavers may not possess the necessary computer skills for their university education although they have been using electronic devices frequently [37]. In fact, there is an urgent call for IT training to be given to fresh university students in order to obtain successful learning outcomes from the use of IT and to satisfy the needs of the future employers [44].

Even though there is scarce evidence which shows that ICT improves learning process and learning outcomes, students seem to like the use of ICT at school and were motivated by it [48]. It is also a common understanding that information and communication technology (ICT) competencies or skills are necessary prerequisites for information literary and life-long learning [1]. Pre-university students who possess these competencies will be able to harness the rapid changes in the era of ICT. It will also prepare them to be better adapted to the university learning environment by applying the facilities provided by this technology. Students who are competent in ICT skills will be able to capture, process, store, and transfer information that will enable them to focus on information content, communication, analysis, searching and evaluation [14]. Therefore, it may be concluded that ICT competencies are indeed a prerequisite to transform Malaysian society towards Vision 2020 and integrating ICT competencies into the Malaysian educational system is the key enabler to achieve this objective. With the success of smart schools and the MSC flagships initiatives, Malaysia is on the right track to become a developed nation by the year 2020.

2 Literature Review

The lack of interest in the research field for students’ ICT or computer competencies (also known as computer performance, computer ability, computer skill, computer efficacy or computer achievement) is in big contrast compared to the serious attention given by researchers in computer attitudes [35]. Furthermore, most of the studies focus on measuring the computer competencies of university or college students or adults and not on primary or secondary students such as those done by [35] and [38].

Though there are some researches and studies being done to investigate the gender differences in terms of ICT competencies or skills, most of them mainly focusing on university academia [72], distance education learners [24], [72], secondary teachers [20], trainee teachers [45], [61], undergraduate students [2], [4], [16], [18], [37], [43], [44], [55], [60], [74], college students [12], [42], [52], [55], [57], lower secondary students [3], [6], [10], [27], [31], [46], [63], [65] - [67], primary students [64], knowledge workers [13], [29] and adults [68].

In the Malaysian context, study done by [67] on the gender difference in ICT competencies among form four students in Kubang Pasu, Kedah may be used as a benchmark for this research. Her research has focused on ICT competencies in writing documents, preparing spreadsheets, scanning documents or images, editing images, preparing slides, sending email messages, creating web pages, uploading documents, searching information on the web, using software for computer assisted learning (CAL), printing documents, creating databases and writing computer programs. Due to rapid changes in IT, new emerging competencies such as creating blogs, using social

networking sites e.g. Facebook, Twitter or Friendster, transferring data using Bluetooth technology, video and audio editing will be included as items of this research. This research can be considered as a continuation of work to further investigate gender differences in ICT competencies among pre university students before they enrol themselves into tertiary education.

There are a lot of researches and studies that showed the existence of significant gender differences in ICT competencies among students. The work done by [59] discovered that the gender differences in terms of Information Technology skills among primary students in city school district in Western Australia remained evident from 1985 to 1991 but it was less significant among secondary students in 1991 compared to 1985. Another research by the Higher Education Research Institute [28] of the UCLA Graduate School of Education and Information Studies reported that female students are half as likely as male students to rate themselves as computer-skilled (23 percent female versus 46 percent male). The male students' dominance in the use of computer in school is also evident in most of the 21 countries being studied by [56] based on the countries' rankings in terms of IT skills.

On the other hand, [55] found that there were gender differences among the male college and university students. For example, 12 percent of male students (35 percent female students) declared their skills in creating and editing Web page as excellent whereas 35 percent among the male students (68 percent female) reported that they do not have any knowledge in this area. However, in word processing, a clear majority of male (59 percent versus 46 percent female) students declared their skill as excellent, and a few male (2 percent versus 6 percent of female) students said that they have no skill at all. Three times more women than men students admitted that they have no skill in word processing. The results defy the common assumption that female students have been predominant in terms of word processing. Besides that, [43] concluded that large proportion of the first year Hong Kong University female students rated themselves as less competent and less confident in computer use, knew less software packages and scored lower marks in the IT proficiency test than their opposite sex.

Research by [50] showed that girls seem to have a lower self-efficacy compared to boys especially in more complicated computer tasks. A study in Dutch show that majority of the grade 5 students regardless of their gender can perform most of the common computer activities such as copying text and saving documents, word processing, or using a draw program [50]. For less common and more advanced computer tasks such as sending an attachment via an e-mail, forwarding an e-mail and downloading programs or documents from the Internet, boys showed more self-efficacy than girls.

Research done by [67] showed that form four male students in the Kubang Pasu district of Kedah, a northern state in Malaysia, have higher perceived ICT competency than their female counterparts. Besides that, [42] discovered that there were significant differences in students' perceptions of computer usefulness and concluded that male students scored higher in this subscale compared to the other three subscales which are liking, confidence and anxiety in the Computer Attitude Scale (CAS) developed by [47]. [49] also found that male students scored higher in terms of perceived computer skills. This was further proven by the study done by [73] which are consistent to those done by [32]. However, [39] stressed that the gender gap is much narrow when both genders are exposed to the same amounts and types of computer experiences. [5] found that gender disparity is obvious if females and males are in a learning environment that requires constant use of specific computer software to support the learning activities. Nevertheless, activities such as handling of computer hardware and maintenance are still dominated by the males [5].

3 Theoretical Framework and Hypothesis

Most studies with regards to IT in education were carried out within a specific theoretical framework [41]. Majority of the researches on IT competencies were conducted based on the concept of diffusion of innovations [58]. For instance, [8] found that there were strong correlation between IT competencies and stages of adoption of technology.

Besides that, there were also researches based on the concerns-based adoption model (CBAM) [23] which is derived from [19]'s work on concerns theory. This theoretical framework focused on the types of educator's concerns when adopting new innovation. For example, [22] discovered that types of concerns exhibited by the teacher were related to the years of teaching experience and level of Internet access in the classroom. In addition to that, the Apple Classrooms of Tomorrow (ACOT) framework for teacher's evolution stages has been frequently used since mid-1980s. The ACOT framework divides the stages of evolution in a classroom into entry, adoption, appropriation and invention [15]. As a result of the combination of ACOT, CBAM and stages of Adoption of Technology [9], a unified construct called technology integration was created [25].

In this study, the theoretical framework adapted from [16] was used (Figure 1). It consists of two entities namely gender and ICT competencies. The arrows show possible relationships or mappings between these two entities. The gender was divided into two categories namely male and female pre university students and the ICT competencies included the skills related to word processing, presentations, spreadsheets, World Wide Web (Internet), electronic mail (email), database, social networking, PC maintenance and utility. The null hypothesis is no gender difference in ICT competencies against the alternative hypothesis of existence of gender difference in this context.

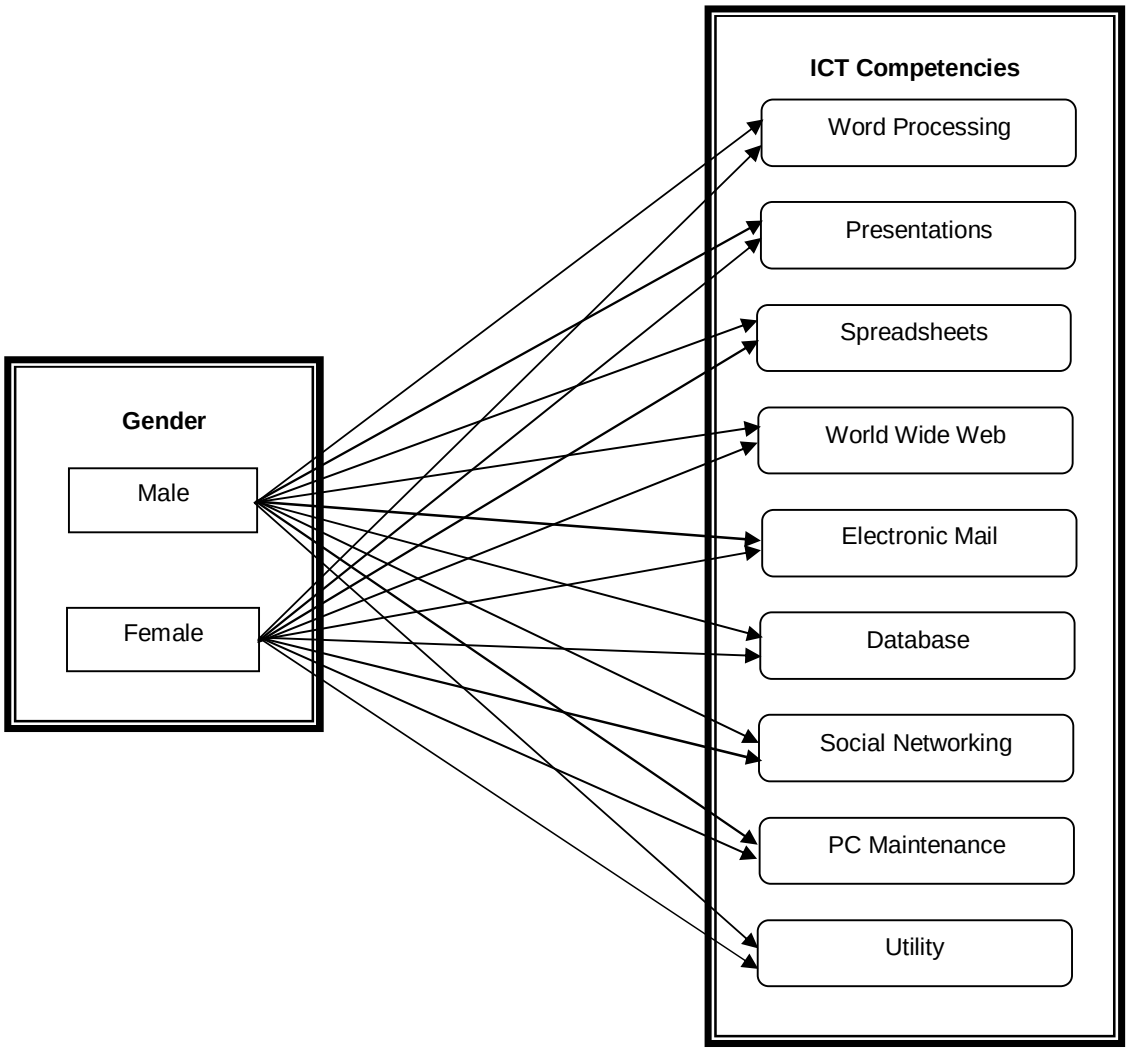

Figure 1: Theoretical Framework

4 Methodology

4.1 Research Context and Design

This study used a research design that includes an outline of what the researcher will do from proposing hypotheses to the analysis of data by means of a framework which describe the relations among variables of this research. It utilizes a quantitative research method to collect sample data regarding gender differences in ICT competencies from a population of pre university students in a Malaysian upper secondary school. The rationale of using quantitative research is because this study involves measurable quantities such as the levels of ICT competencies (Likert's scale of 1 to 5).

4.2 Sampling and Data Collection

The population of this research is all the pre university students consisting of lower and upper pre university students in a Malaysian government upper secondary school. The size of the population is two hundred and sixty (260) students. The researcher has selected eighty per cent (N = 208) of the population as the sample of this research. This is good enough considering the normal standard of thirty per cent or over to represent a population [71]. Random sampling technique has been used in this research. A total of two hundred and eight questionnaires have been administered to the lower pre university (N = 111) and upper pre university (N = 97) comprising of students from both science and art streams. Out of these, 49 samples were unusable due to incomplete or duplicate responses. Based on the 159 usable samples the response rate for this research is 76.8 percent.

4.3 Variable Measurement

Independent variables: The independent variable used in this research is the genders of the pre university students.

Dependent variables: Nine ICT competencies were used as the dependent variables. Each of the competencies was measured using the 5-point Likert's scale. The scores ranges from 1 to 5 (1 as 'no skill', 2 as 'little skill', 3 as 'average skill', 4 as 'skilful' and 5 as 'very skilful').

5 Results

5.1 Sample Profile

The demographic profile of the surveyed respondents is presented in Table 1, which includes gender, age, level of study, stream and area of home. The total sample for the survey consists of 159 respondents. The gender distribution of the survey respondents is 38.4 percent males and 61.6 percent females.

The result indicated that 85.6 percent of the pre university students are in the range of 18 and 19 years old. 56 percent of them are studying in lower pre university level and the rest are studying at the upper pre university level. In terms of streaming, 28.9 per cent are in physical sciences, 31.4 percent in biological science, 17.0 percent in accountancy and 22.6 percent in arts, humanity or history. In this research, 61.6 percent of the respondents come from rural area while 38.4 percent stay in urban area.

Table 1: Demographic Profile of Respondents

Variables		**Frequency**	**Percentage (%)**
Gender	Male	61	38.4
	Female	98	61.6
Age (Years)	16	1	.6
	17	21	13.2
	18	68	42.8
	19	68	42.8
Level of study	Lower pre university	89	56.0
	Upper pre university	70	44.0
Stream	Physical Sciences	46	28.9
	Biological Sciences	50	31.4
	Accountancy	27	17.0
	Arts/Humanity/History	36	22.6
Area of home	Rural	98	61.6
	Urban	61	38.4

As illustrated in Table 2, 61.0 percent of the students have more than four years of computer experience, 11.9 percent have 2 to 3 years experience, 20.8 percent have 1 to 2 years experience and only 6.3 percent have less than a year of computer experience.

It was also found that 57.3 percent of the students use computer for less than 9 hours a week, 18.9 percent use computer between 10 to 19 hours a week, 8.8 percent use 20 to 24 hours a week and 15.1 percent use more than 25 hours weekly.

Table 2: Computer Experience * Gender Cross-tabulation

			Gender		
			Male	Female	Total
Computer experience	0 - 1 year	Count	4	6	10
		% within Gender	6.6%	6.1%	6.3%
	1 - 2 years	Count	12	21	33
		% within Gender	19.7%	21.4%	20.8%
	2 - 3 years	Count	5	14	19
		% within Gender	8.2%	14.3%	11.9%
	4+ years	Count	40	57	97
		% within Gender	65.6%	58.2%	61.0%
Total		Count	61	98	159
		% within Gender	100.0%	100.0%	100.0%

Table 3 indicated the distribution of English proficiency among the respondents. Most of them have moderate language proficiency (62.3 percent), 16.4 percent have poor proficiency and 7 percent not well verse in English. Only 17 percent can master the language at good and excellent level.

Table 3: English Proficiency * Gender Cross-tabulation

			Gender		
			Male	Female	Total
English proficiency	Very poor	Count	4	3	7
		% within Gender	6.6%	3.1%	4.4%
	Poor	Count	6	20	26
		% within Gender	9.8%	20.4%	16.4%
	Moderate	Count	41	58	99
		% within Gender	67.2%	59.2%	62.3%
	Good	Count	8	13	21
		% within Gender	13.1%	13.3%	13.2%
	Excellent	Count	2	4	6
		% within Gender	3.3%	4.1%	3.8%
Total		Count	61	98	159
		% within Gender	100.0%	100.0%	100.0%

The computer or notebook ownership rate and the Internet penetration rate among respondents are shown in Table 4 and 5. It demonstrated a 71.7 percent in terms of computer or notebook ownership and 55.3 percent for Internet account ownership. This shows that although the rate of computer or notebook ownership is satisfactorily but the Internet penetration rate among respondents is still not on par with the target set forward by the Malaysian Government.

Table 4: Owns Computer or Notebook * Gender Cross-tabulation

			Gender		
			Male	Female	Total
Owns computer or notebook	Yes	Count	43	71	114
		% within Gender	70.5%	72.4%	71.7%
	No	Count	18	27	45
		% within Gender	29.5%	27.6%	28.3%
Total		Count	61	98	159
		% within Gender	100.0%	100.0%	100.0%

Table 5: Owns Internet Account * Gender Cross-tabulation

			Gender		
			Male	Female	Total
Owns Internet account	Yes	Count	33	55	88
		% within Gender	54.1%	56.1%	55.3%
	No	Count	28	43	71
		% within Gender	45.9%	43.9%	44.7%
Total		Count	61	98	159
		% within Gender	100.0%	100.0%	100.0%

5.2 Normality Test

Normality of data was verified by using histogram, box-plot, stem-plot, normal Q-Q plot, detrended Q-Q plot and the Kolmogorov-Smirnov and Shapiro-Wilk normality test. The results showed that the data is non-normal. Therefore non-parametric tests were used in this research.

5.3 Construct Validity

[21] opine that construct validity measures the level to which a scale measures what it intends to measure. The reliability of the questionnaire was tested using Cronbach's alpha. An alpha value of 0.70 or greater indicates high reliability and good internal consistency [17], [53]. Since Cronbach's alpha can be interpreted as a correlation coefficient, it will only take values in the range of 0 to 1. [40] asserted that an alpha value of 0.8 is appropriate for cognitive tests like intelligence tests but for ability tests a cut-off point of 0.7 is more suitable. Table 6 shows the result of the reliability analysis for all constructs in this study.

Table 6: Construct Scale Reliability

ICT competency	**Cronbach's alpha**
Word processing	0.963
Presentation	0.976
Spreadsheet	0.970
World Wide Web	0.959
Email	0.971
Database	0.972
Social networking	0.952
PC maintenance	0.967
Utility	0.935

5.4 Descriptive Statistics

Table 7 shows the mean and standard deviation of the respective ICT competencies among the pre university students based on the 5-point Likert's scale. The average levels of competencies fall in the range between 2.5 to 3.3 which are considered moderate. Word processing has the highest level for both genders. The male students have the lowest level of spreadsheet competency while their female counterparts have the lowest level of database competency.

Table 7: ICT Competencies Statistics

ICT competency	Male		Female	
	Mean	Std. Deviation	Mean	Std. Deviation
Word processing	3.1039	1.09666	3.2428	.90698
Presentation	3.0548	1.14376	2.9914	1.04239
Spreadsheet	2.6115	.99114	2.5623	.93359
World Wide Web	2.8618	1.17867	2.6722	.97381
Email	3.0293	1.30112	2.8751	1.06098
Database	2.7307	1.15945	2.5147	.99338
Social networking	3.0544	1.25141	3.0310	1.14793
PC maintenance	3.0508*****	1.18175	2.5796	1.10956
Utility	3.0820	1.24207	2.7448	1.06383

***** Significant at level 0.05 (2-tailed)

There are obvious gender differences in the rankings of ICT competencies for both genders as shown in Table 8.

Table 8: ICT Competency Rankings

Male			Female		
Rank	**ICT Competency**	**Mean**	**Rank**	**ICT Competency**	**Mean**
1	Word Processing	3.1039	1	Word Processing	3.2428
2	Utility	3.0820	2	Social Networking	3.0310
3	Presentation	3.0548	3	Presentation	2.9914
4	Social Networking	3.0544	4	Email	2.8751
5	PC Maintenance	3.0508	5	Utility	2.7448
6	Email	3.0293	6	World Wide Web	2.6722
7	World Wide Web	2.8618	7	PC Maintenance	2.5796
8	Database	2.7307	8	Spreadsheet	2.5623
9	Spreadsheet	2.6115	9	Database	2.5147

5.5 Mann-Whitney Analysis

Since an ICT competency is measured by multiple items, the average score of the multi-items for a construct is computed and used in this study. The results of the Mann-Whitney analysis are summarized in Table 9.

Table 9: ICT competencies' Mann-Whitney Test Statistics[a]

	wordproc	presentation	spreadsheet	www	email	database	socialnet	pc	utility
Mann-Whitney U	2861.500	2776.000	2862.000	2677.500	2699.000	2664.500	2933.500	2273.500	2468.000
Wilcoxon W	4752.500	7627.000	7713.000	7528.500	7550.000	7515.500	7784.500	7124.500	7319.000
Z	-.453	-.757	-.453	-1.105	-1.030	-1.158	-.197	-2.540	-1.851
Asymp. Sig. (2-tailed)	.651	.449	.650	.269	.303	.247	.844	**.011***	.064

a. Grouping variable: Gender
***** Significant at the 0.05 level (2-tailed)

It was found that there were no significant gender differences for word processing, presentation, spreadsheet, World Wide Web, database, social networking and utility. However, the result verified that PC maintenance demonstrated a significant gender difference with the male pre university superior to their female counterparts.

In terms of computer experience and usage, there were no significant gender differences as indicated by the Mann-Whitney statistics in Table 10.

Table 10: Computer Experience and Usage's Mann-Whitney Test Statistics[a]

	Computer experience	Computer usage
Mann-Whitney U	2818.000	2952.500
Wilcoxon W	7669.000	7803.500
Z	-.694	-.134
Asymp. Sig. (2-tailed)	.488	.894

a. Grouping Variable: Gender

As shown in Table 11, there were also no significant gender differences pertaining to the computer ownership and Internet account ownership among the pre university students.

Table 11: Computer Ownership and Internet Account's Mann-Whitney Test Statistics[a]

	Owns computer or notebook	Owns Internet account
Mann-Whitney U	2930.500	2928.500
Wilcoxon W	7781.500	7779.500
Z	-.266	-.249
Asymp. Sig. (2-tailed)	.791	.803

a. Grouping Variable: Gender

5.6 Correlation Analysis

Correlation analysis was chosen in order to investigate the relationship between English proficiency and ICT competencies among pre university students. Spearman's correlation coefficient was calculated due to non-normality of data. In this study, all the associated pairs of variables are significant at level 0.05. Table 12 shows that the correlations range is less than 0.9. Therefore, there was no evidence of significant multicollinearity among the research variables.

Table 12: Spearman's Correlation Coefficient

	English proficiency	wordproc	presentation	spreadsheet	www	email	database	socialnet	pc	utility
English proficiency	1.000									
wordproc	.471**	1.000								
presentation	.540**	.870**	1.000							
spreadsheet	.443**	.711**	.782**	1.000						
www	.394**	.668**	.653**	.667**	1.000					
email	.462**	.689**	.686**	.700**	.766**	1.000				
database	.369**	.584**	.628**	.716**	.748**	.682**	1.000			
socialnet	.492**	.577**	.586**	.572**	.723**	.802**	.549**	1.000		
pc	.309**	.556**	.613**	.577**	.686**	.607**	.644**	.625**	1.000	
utility	.414**	.673**	.680**	.651**	.779**	.732**	.722**	.682**	.800**	1.000

****** Correlation is significant at the 0.01 level (2-tailed).

6 Discussion

The findings have supported the alternative hypothesis that there is significant gender difference in ICT competencies among pre university students only in the PC Maintenance competency where the male students scored higher degree of competency compared to their female counterparts. The finding is in agreement with the research findings of [32], [42], [44], [49], [50], [54], [67] and [73] but contradicts to those of [33], [11], [26], [39] and [70]. For the other eight ICT competencies, the null hypotheses of no significant gender differences were supported instead. The non-significant findings are in agreement with those of [33], [11], [26], [39] and [70] but contradicts to those of [32], [42], [44], [49], [50], [54], [67] and [73].

Generally the levels of ICT competencies for both genders are still very low and range from 2.5 to 3.2 of the full scale of 5 point as indicated in Table 8. Measures and efforts must be undertaken to further improve the levels of ICT competencies among pre university students. Since not every student can afford to have compute access at home, school plays an imperative role in providing opportunities for students to use computers as frequently as possible [67]. Teachers and school administrators much ensure that computers in the access centres or laboratories are used for beneficial activities and not only for recreational activities such as playing games or online chatting. Applications such as spreadsheet, database, word processing and presentation should be utilized for educational purposes besides searching for useful information via web browsing. Parents too play an important role in providing the necessary facilities like computer and Internet access at home whenever possible to encourage and motivate their children in adopting ICT in their daily lives.

Although statistically both genders do not have significant gender differences in eight out of the nine ICT competencies, the male students still have a slightly higher mean score in all the ICT competencies except the word processing competency as shown in Table 8. The female students have a higher mean score in word processing may be justified by the fact that females are better typists and tend to use more word processing applications compared to their male counterparts. Due to frequent and long duration of application usage, the females must have been able to master more skills and competencies in terms of word processing in comparison to the male students. Therefore the higher mean score is not surprising and is justified reasonably.

7 Conclusion and Implications

The research indicated that there are no significant gender differences in terms of word processing, presentation, spreadsheet, World Wide Web, email, database, social networking and utility competency among the pre university students. However, it was found that there is a significant difference in terms of PC maintenance competency. Furthermore, there are no significant gender differences in terms of computer usage and computer experience. The research also revealed that English proficiency has a positive correlation with the ICT competencies. These findings have brought to the following implications and recommendations:

7.1 Practical Implications and Recommendations

7.1.1 Supply of ICT Personnel in Network and Mobile Technologies Sector in Malaysia

By identifying the gender differences in ICT competency among the pre university students, proper measures may be taken to enhance the education of network and mobile technologies in Malaysia thus enabling us to provide more ICT savvy personnel who are capable of contributing the needed workforce in the mobile and networking sectors. The findings of this study would surely improve the shortage of the ICT personnel in these industries. With adequate human capital, it will ensure the success of major ICT initiatives such as MSC, MyICMS886 and HSBB. It is only with sufficient and competent ICT workforce, Malaysia will be able to achieve the status of a developed nation by the year 2020 as well as the formation of a high-income and knowledge based society.

7.1.2 Teaching and Learning of ICT Subjects in Schools

A significant gender difference in PC maintenance has an implication to the teaching and learning of ICT subjects in schools whereby the stereotype method of teaching currently used in classroom is no more suitable to cater to this gender difference. Teachers and instructors must try to apply versatile methods of teaching which are more student-centred such as cooperative learning, mastery learning and contextual learning instead of the conventional teacher-centred approach.

With the use of cooperative learning, students from both genders will mingle with each other and learning together through cooperation and teamwork. This will help them to eliminate the gender difference where the male students will guide the females to master the PC maintenance skill. The steps used in conducting a cooperative learning session are elaborated in the following diagram:

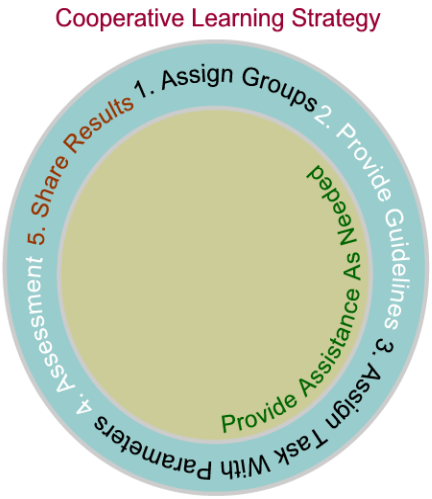

Figure 2: Cooperative Learning

Through the mastery learning approach, all students regardless of their gender will proceed to the next learning outcome only if they have mastered the required PC maintenance competence. By using mastery learning approach, the problem of gender difference may be mitigated.

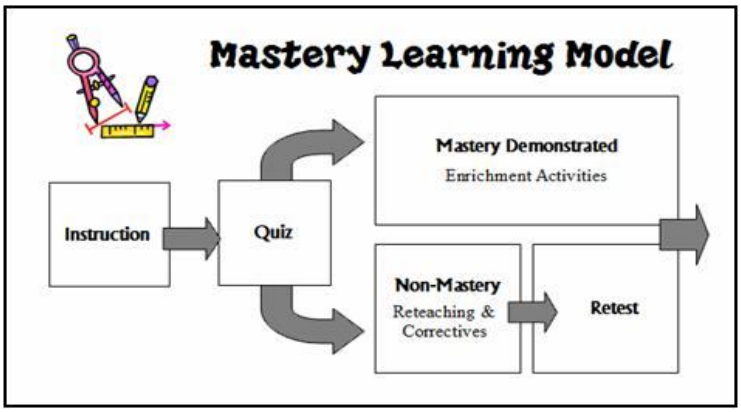

Figure 3: Mastery Learning

Contextual learning approach is another option where students regardless of their gender will learn the PC maintenance skill by having actual practical experiences through workshops and hands-on experiments outside the classrooms. For example, students may go to a computer factory and see how computers are actually repaired and maintained. The concept of contextual learning approach is illustrated in the following diagram:

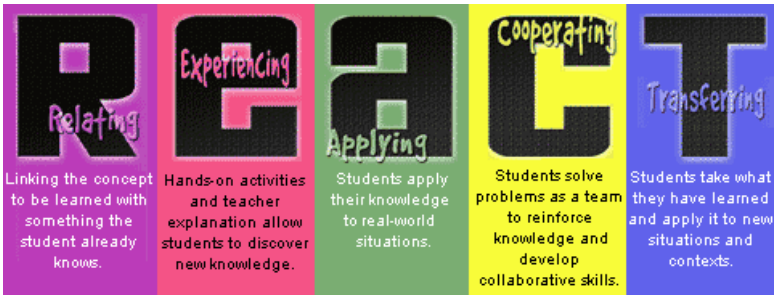

Figure 4: Contextual Learning

Besides that the use of self-access learning (SAL) or modular instruction will reduce the impact of this gender difference since the female students may have more time to learn and practice the PC maintenance competency at their own pace. They may proceed to next module after they have mastered the PC maintenance skill while getting the necessary guidance from the teacher or instructor.

In terms of computer experience and usage, the implication from the research implies that teachers and instructors do not have to worry about these gender differences and may proceed with their teaching as usual by assuming that both sexes have the same level of ICT knowledge background. Therefore, they may use discovery learning loop as one of the exploratory approaches to disseminate ICT related knowledge and competencies to the students. This will bring more fun and excitement compared to the conventional chalk and talk approach which is very much teacher-centred.

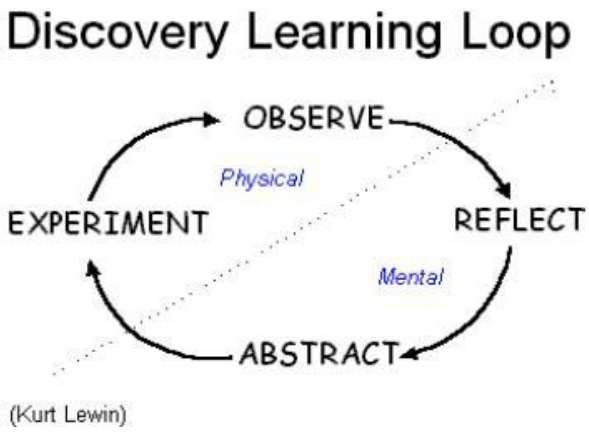

Figure 5: Discovery Learning

7.1.3 Evaluation of ICT subjects in schools

When conducting evaluation and assessment on ICT subjects such as Computer Literacy (form 1 to 3), Information Technology (form 4 & 5) and Computing (pre university/form 6); teachers and instructors should always bear in their minds that there exists a significant gender difference in terms of PC maintenance. Although a common question paper is used in school, it is recommended that this common practice should be improvised by providing different sets of question paper according to students' gender especially with regards to PC maintenance. Another alternative is to have two sets of marking schemes that are gender based.

In terms of classroom assessment, there are basically two types of assessment or evaluation, namely the formative and summative assessment. In order to improvise instructional methodologies and students' feedback during the teaching and learning processes, teachers use formative assessments which are continuous evaluations, observations and reviews in a classroom. For example, if a teacher observes that some students do not grasp a concept, he or she can design a review activity or use a different instructional strategy. Likewise, students can monitor their progress with periodic quizzes and performance tasks. The results of formative assessments are used to modify and validate instruction. Examples of formative assessments are monthly tests, quizzes, diagnostic tests, lab reports and assignment or coursework and project.

On the other hand, summative assessments are typically used to evaluate the effectiveness of instructional programs and services at the end of an academic year or at a pre-determined time. Summative assessments which aim at making a judgment of student competency after a complete instructional phase are used to ascertain whether a student has mastered a specific competency and to identify instructional areas that require extra attention. Examples of summative assessments are final semester examination, national tests such as PMR, SPM and STPM examination.

It is recommended that a formative evaluation or assessment be used when it comes to PC maintenance competency. This is because a formative evaluation may gauge the progress of a student more accurately and immediate remedial actions can be taken to address this gender difference. For instance, if a female student has problem in assembling the CPU during a practical test then the teacher may give extra class or tuition to this particular student in a one to one basis. If summative evaluation is used instead then it would be too late for any rectification to be done since the summative evaluation is conducted at the end of the school semester.

In the context of testing, there are two types of tests namely norm-referenced tests (NRTs) and criterion-referenced tests (CRTs). NRTs compare the performance among different examinees. Standardized examinations such as the SPM and STPM are norm-referenced tests. The goal NRTs is to rank the set of examinees so that decisions about their opportunity for success (e.g. college entrance) can be made. CRTs are different in that examinee's performance is compared to a pre-defined standard or set of criteria. The goal of CRTs is to verify whether has or has not the candidate demonstrated mastery of a certain skill or set of skills via "pass' or 'fail' results which are applied in deciding job entry, licensure or certification.

Due to the significant gender difference in PC maintenance, it is recommended that a CRT be used to determine the performance of the students in PC maintenance competency to test whether they have mastered this skill. It would not be fair to use NRT to compare the male and female students since the males are the dominants and are superior to their female counterparts.

8 Limitation and Future Studies

By no means are the ICT competencies investigated in this research the only ones that are learned by the pre university students. There are other ICT competencies such as programming, scripting, multimedia, animation and etc. In fact new software and applications emerge each day and therefore future research should also look into these new competencies. Besides that due to the rapid education transformations and changes of syllabus from time to time, future research should be conducted every five years to obtain the latest impacts and implications of these changes towards gender differences in ICT competencies among students. It is also suggested that future researchers should conduct a study on pre university students from matriculation colleges as well as students who enrolled in foundation programs in local public and private universities.

Even tough the research has found the answer to the research question on the existence of gender differences in terms of ICT competencies among pre university students, future research should further investigate the factors that lead to the emergence of the gender differences. Exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) may be applied to investigate the determinants of the gender differences in ICT competencies. This would further answer the question on why there is a gender difference in PC maintenance among the pre university students.

It would also be beneficial if future research can investigate factors that influence the level of ICT competencies among pre university students so that measures may be taken to upgrade these levels. Although this research has been able to provide the needed information which could contribute to the body of knowledge regarding gender differences in terms of ICT competencies among pre university students, future research may further investigate the subject matter for first year undergraduate at local public and private universities and colleges to explore the unknown frontier to gather some insight pertaining to the gender differences of these undergraduates.

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