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ASSESSING PRE-SERVICE TEACHERS' INFORMATION TECHNOLOGY (IT) PREPAREDNESS AT UNIVERSITI PUTRA MALAYSIA

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Abstract. This study examined pre-service teachers' IT preparedness at Universiti Putra Malaysia. IT preparedness is measured in terms of their actual IT skills, knowledge and attitudes toward IT. Three hundred and sixty undergraduate students majoring in education participated in this study. This study used an instrument comprising 74 task based items, 25 multiple choice items and 34 Likert scale items to measure IT skills, knowledge and attitudes respectively. The result suggested that the pre-service teachers are highly IT prepared. More specifically, the majority of them have a high level of IT skills, reasonable level of IT knowledge with positively high attitudes toward IT. The result also revealed that two extreme groups existed, those who are highly proficient in certain productivity tools and those who are not.

Keyword: IT preparedness, IT skills, knowledge about IT, attitudes toward IT, pre-service teachers

Abstrak. Penyelidikan ini mengkaji kesediaan guru praperkhidmatan terhadap teknologi maklumat di Universiti Putra Malaysia. Kesediaan terhadap teknologi maklumat dalam kajian ini adalah diukur dalam tiga domain iaitu kemahiran teknologi maklumat guru, pengetahuan teknologi maklumat dan sikap mereka terhadap teknologi maklumat. Tiga ratus dan enam puluh mahasiswa dan mahasiswi yang mengambil bidang pendidikan sebagai major mengambil bahagian di dalam kajian ini. Kajian ini menggunakan instrumen yang mengandungi 74 item yang berasaskan tugasan, 25 item pelbagai pilihan dan 34 item skala Likert untuk mengukur kemahiran IT, pengetahuan dan sikap masing-masing. Dapatan kajian mendapati bahawa kesedian teknologi maklumat guru-guru adalah tinggi. Secara spesifik, majoriti guru-guru mempunyai kemahiran teknologi maklumat yang tinggi, tahap pengetahuan IT yang memadai dengan sikap yang sangat positif terhadap teknologi maklumat. Hasil kajian juga menunjukkan wujud dua kumpulan yang ekstrim, mereka yang mempunyai kecekapan yang tinggi di dalam alat produktiviti dan mereka yang tidak cekap.

Kata kunci: kesediaan IT, kemahiran IT, pengetahuan IT, sikap terhadap IT, guru pra perkhidmatan

1.0 INTRODUCTION

Malaysia has a national ambition called Vision 2020, the purpose of which is to attain developed-nation status by the year 2020 (Mahathir Mohammed, 1998).

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To achieve the substance of Vision 2020, the government has set up a blueprint for the Multimedia Super Corridor (MSC). The MSC is a massive 750-square-kilometer high-tech information zone encompassing the Kuala Lumpur City Center (KLCC), Putrajaya (administrative center) and the Kuala Lumpur International Airport (KLIA). To spearhead the development of the MSC and give shape to its environment, seven initiatives for multimedia applications have been identified. These initiatives are borderless marketing, smart schools, electronic government, multi-purpose card, telemedicine, research and development and worldwide manufacturing webs. Of these, the smart school initiative is regarded by the Prime Minister as a specific response to Malaysia's need to make the critical transition from an industrial economy to a knowledge-based society (Mahathir Mohammad, 1998). A group of 84 Smart Schools was created by the Ministry of Education in 1999 as pilot schools, which are a sampling of a range of schools nationally (Smart School Project Team, 1997).

The Smart School Project Team (1997) stressed that a comprehensive teacher education programme, which introduces IT elements, will be critical to the success of the Smart School concept. Such an approach the Team said, will enable teachers to carry out their responsibilities as facilitators in the classroom, by equipping them with specific IT knowledge and skills as well as the right attitudes toward IT. IT knowledge, skills and attitudes toward IT are the measurable variables normally used to represent the degree of teachers' preparedness to use IT in their teaching (Wild, 1995). In line with such measures of IT preparedness, the effectiveness of IT courses in initial teacher training programmes is typically described in terms of actual or perceived cognitive outcomes, as well as changes in attitudes and confidence (McFarlane and Jared, 1994; Oliver, 1994).

2.0 LITERATURE REVIEW

There are several learning theories and models which are related to IT. These new theories and models suggest that the degree of IT preparedness can be measured in terms of knowledge, skills and attitudes. They seem to direct the attention to these three variables when an interaction occurs between the machine and the human.

One of the most influential explanations of skills acquisition is the Adaptive Control of Thought (ACT) theory (Anderson, 1983). Essentially, Anderson (1983) distinguished the learning of a skill in relation to two different types of knowledge, which are known as declarative and procedural. According to Anderson, declarative knowledge is what we call knowledge or propositions about what is true. It is a form of explicit memory and conscious efforts must be made to retrieve this information. Anderson also postulated that the skills that form the ability to carry out procedures correctly are procedural knowledge. It is a form of implicit memory and includes motor skills. The ACT theory attempts to show how cognition actually produces action. In a simpler form, it means that skills acquisition involves knowledge and skills.

Closely related to this theory is the Technology Acceptance Model (TAM) (Davis, Bagozzi and Warshaw, 1989). It was developed to explain computer usage behaviour. TAM postulates that computer usage is determined by a behavioural intention to use a system which is jointly determined by a person's attitudes towards using the system and its perceived usefulness. This attitude is also jointly determined by perceived usefulness and perceived ease of use. According to TAM, perceived usefulness is influenced by perceived ease of use and external variables.

This model posits that the use of an actual system, for example, a computer based one, is determined by the user's attitudes toward it. The actual use can be measured in terms of the user's knowledge and skills of the system (Speier, Morris and Briggs, 1997). Wilson (1990) made the connection between the three variables when he stressed that teachers' IT preparedness should be measured in terms of knowledge, skills and attitudes. There are however, several external variables to be considered.

There is a significant body of evidence which supports the notion that gender does play a role in influencing behaviours in a wide variety of domains. In fact, studies on gender differences on computers among teachers are more than a decade old. Loyd and Gressard (1986) found male teachers to be more confident and less anxious toward computers compared to their female counterparts. A study by Blackmore, Stanley, Coles, Hodgkinson, Taylor and Vaughan in 1992 showed similar findings to those of Loyd and Gressard (1986). The data were gathered over a three-year period and the results indicated that males appear to be more positive in their attitudes toward IT than females. Gender differences were also found in Liao's (1997) study which measured teachers' attitudes toward educating computing in Taiwan. As predicted, the study showed that male teachers scored significantly higher than females (Liao, 1997).

Venkatesh and Morris (2000) also suggested that prior computer experience could also confound gender differences in technology perceptions and usage even though their study proved otherwise. Liao (1993) reported that the longer teachers' exposure to computers and the more types of computers prospective teachers had experienced, the more comfort they felt in working with computers. Huang, Waxman and Padron (1995) measured teacher education computing course using an instrument to measure perception of gender related differences in working computers, level of comfort in using computers, perception of the value of computers, liking for using computers and also their view of ability-related differences in their students' computer utilisation. The results showed that years in college, length of computer usage and types of computer used had a significant positive correlation with the attitudes. Huang *et al.* (1995) concluded that technology experience influences teachers' attitudes. This study found that previous technology use and attitudes toward technology are significantly related, although the magnitude of relationship varies, depending upon the specific attitudinal dimension. Wild (1995) concurred with Huang *et al.* (1995) when he stated that experience of using computers before taking a computer related course enhances

students' procedural skills in hardware and software use rather than their knowledge of classroom uses of IT.

While studies have also been conducted locally to find out teachers' level of IT skills, knowledge or attitudes. Ab. Rahim Bakar and Shamsiah Mohamed (1998) found the majority of in-service Malaysian Vocational and Technology teachers do not have a good command of knowledge and related skills. The study showed the respondents could not do programming, and more than half were not able to use word processing, desktop publishing, the database, and the electronic spreadsheet. In a recent study, Wong, Kamariah Abu Bakar, Ramlah Hamzah and Rohani Ahmad Tarmizi (2002) assessed in-service teachers' IT preparedness (skills, knowledge and attitudes) after undergoing an in-service IT training and revealed that they possess a reasonable level of IT skills where they scored highest in word processing and the lowest in the Internet. It is heartening to know, however, that the majority of them have average and above average knowledge of IT and positively high attitudes toward IT. They concluded that the in-service teachers were highly IT prepared.

Suffice to say, the theoretical grounding of this research comes from the Adaptive Control of Thought (ACT) Theory (Anderson, 1983) and Technology Acceptance Model (TAM) (Davis, Bagozzi and Warshaw, 1989). The ACT and TAM have provided a basis for determining IT knowledge, skills and attitudes as the main variables in this study.

3.0 STATEMENT OF THE PROBLEM

The pilot Smart Schools that started in 1999 will act as a nucleus for the future Smart School teaching concepts and materials, skills and technology. By the year 2010, if the 1997 planning is followed, all 10,000 of Malaysia's primary and secondary schools will be Smart Schools (Smart School Project Team, 1997). This means that in the next decade the entire population of approximately 450,000 teachers in Malaysia must be fully prepared to teach in Smart Schools nation-wide. The pressure on teachers to become IT literate as well as to understand the education implications of the new technology has, therefore, become urgent. It is now envisaged that all teachers will become skilled in the use of IT and the integration of IT in the teaching-learning process (Smart School Project Team, 1997). This is important because all teachers will have to use IT in the classroom. However, before they can integrate this new technology, these teachers must be trained to be skilled and knowledgeable about IT with the right attitudes. For this reason, teachers must be assessed thoroughly by the educational authorities before they teach in schools to determine if they are IT prepared. With the implementation of Smart Schools nationwide, there is a growing educational interest in the assessment of teachers' IT skills, knowledge and attitudes. These abilities and qualities cannot be assessed satisfactorily by merely asking teachers to rate themselves using self-perceived questionnaires; they need to be assessed by monitoring performance in a real practical test.

4.0 OBJECTIVES OF THE STUDY

The objectives of the study were to

(i) assess the pre-service teachers' actual IT skills;
(ii) assess the pre-service teachers' knowledge about IT;
(iii) assess the pre-service teachers' attitudes toward IT;
(iv) assess the pre-service teachers' IT preparedness;
(v) assess the relationships between teacher IT preparedness and three demographic variables (age, teaching experience and prior computer experience);
(vi) determine the differences between female and male pre-service teachers in terms of IT preparedness.

5.0 METHOD

The data for this research were collected from students at the Faculty of Educational Studies (FES), Universiti Putra Malaysia during the May 2000/2001 and November 2001/2002 semesters.

5.1 INSTRUMENTATION

The instrument was developed and validated by Wong (2002) and was constructed in the Malay Language. Three domains were measured in this instrument. They were skills, knowledge and attitudes. The instrument measured skills first followed by knowledge and lastly attitudes. Based on the second author's past experience, partici pants were more likely to complete tasks that required more effort followed by tasks that required less effort. For that reason, the instrument was designed to measure skills which tasks required more effort followed by knowledge and attitudes (Wong, 2002).

The instrument comprised Parts A, B and C. Part A was paper based while Parts B and C were web based. Part A measured the teachers' actual IT skills. The skills were measured in terms of the teachers' ability to execute a series of 74 tasks. The tasks were measured in two dimensions based on the table of content specification. The first dimension comprised content categories pertaining to productivity tools (word processing, spreadsheet, database and presentation), World Wide Web (WWW) and electronic mail while the second dimension comprised task categories (basic operation, management and design). All skills measured did not require direct observation. Each item was a task that the participant was required to perform. For that reason, the tasks could be categorised into 'able to' and 'unable to'. Examples of items in Part A are shown below:

a. Buka fail yang bernama "wordp" dalam disket yang telah dibekalkan (anda akan melihat artikel yang bertajuk "Petroleum").

b. Tukar tajuk artikel kepada fon Arial, saiz 14, gelap (bold) dan gariskannya.

c. Tukar jarak baris kepada langkau dua baris (double spacing) untuk isi artikel.

Part B measured their knowledge about IT based on the table of content specification which comprised two dimensions. It was measured in terms of 25 multiple-choice questions. The first dimension comprised system hardware, system software, WWW and electronic mail while the second dimension comprised the three lower levels of Bloom's Taxonomy (Bloom and Krathwohl, 1975). Four alternatives were constructed for each item. An example of an item in Part B is shown below.

5. Apakah fungsi peranti yang menyambungkan komputer kepada talian telefon?

A. Ia menukar arus terus kepada arus ulang-alik dan sebaliknya.

B. Ia menukar isyarat mikro kepada isyarat digital dan sebaliknya.

C. Ia menukar isyarat digital kepada isyarat analog dan sebaliknya.

D. Ia menukar gelombang sinus kepada gelombang kosinus dan sebaliknya.

Lastly, Part C measured the teachers' attitudes toward IT based on the table of content specification and consisted of two dimensions. The first dimension comprised specific software applications, software applications in general, computer and IT in general. The second dimension consisted of confidence, usefulness, anxiety and aversion. This part comprised 34 five-point Likert's scale statements. The five choice Likert scale was used, hence the scale in Part C ranged from "strongly agree=5, agree=4, not sure=3, disagree=2, strongly disagree=1" for positive items and vice versa for negative items. Examples of items in Part C are shown in Table 1.

A pilot test was conducted with 49 participants prior to the actual study. KR-20 was calculated for Parts A and B while Cronbach's coefficient alpha was computed for Part C. The reliability of scores for Parts A and B were .94 and .85 respectively. The reliability of scores for Part C was recorded at .92.

Table 1 Examples of items measured in Part C

		Sangat Setuju	Setuju	Tidak Pasti	Tidak Setuju	Sangat Tidak Setuju
1.	Penggunaan mel elektronik memudahkan saya berhubung dengan rakan-rakan saya.	○	○	○	○	○
2.	Internet adalah berguna untuk mencari maklumat.	○	○	○	○	○

5.2 Sample Selection

A total of 360 teachers at the FES, UPM participated in the study voluntarily. All of them had taken at least a compulsory basic IT course at the time of data collection. IT in Education (EDU 3033) is a compulsory subject for all education major students in this university. Data from 44 participants could not be used because they did not complete the assessment. Of the 316 teachers providing usable data, 15.1% were males and 84.9% were females. The majority of them did not have prior teaching experience (62.7%). The rest were teachers who have taught before in schools before furthering their studies in FES, UPM. These teachers had between 1 and 21 years of teaching experience in schools. Seventy percent of the participants had prior computer experience before taking a basic IT course. Their prior computer experience ranged from 6 months to 14 years. The mean age of the participants was 22.4 years old (SD=2.26). The participants were from seven different programmes. Table 2 shows the percentages of participants from each programme. Participants from the Accounting and Education programme took EDU 3033 as an elective course.

Table 2 Participants according to Programmes of Study

Programme of study	Percentage (%)
Bachelor of Education in Guidance and Counselling	34.2
Bachelor of Education in Agricultural Science	22.2
Bachelor of Education in Home Economics	20.3
Bachelor of Education in English as a Second Language	10.8
Bachelor of Education in Physical Education	5.7
Bachelor of Education in Malay as a First Language	4.4
Accounting and Education	2.4

5.3 Data Collection

The tests were conducted in the computer laboratories in FES, UPM. All computers were installed with Microsoft Office 2000. At the beginning of the test, the first author briefed the participants about the assessment that was being carried out. The participants were required to attempt Part A of the instrument, followed by Parts B and C respectively. Each student was given a desktop to work on, access to the Internet and a piece of diskette to save their work into. The participants were required to save their work for Part A only in a floppy diskette. The answers and responses of the participants in Parts B and C were collected via e-mail. At the end of the session, the participants were given stickers for them to paste on the diskettes and the first author collected back the diskettes as well as Part A that was paper based.

6.0 RESULTS

The results of this study are reported by objective. The internal consistency of the instrument was also calculated. The KR-20 for item scores of skills and knowledge were .98 and .80 while the Cronbach's alpha of item scores for attitudes was recorded at a high of .93.

6.1 Objective 1: Actual IT Skills

The results in Table 3 show that the majority of the participants had high level of IT skills (69.9%). The lowest score recorded was 9.0 and the highest score was 98.0. The mean score for IT skills was 70.0 (SD= 27.0). While Table 4 shows the level of skills according to the productivity tools. The participants had the highest level of skills in using word processing (89.3%) followed closely by spreadsheet (71.5%) and presentation (69.6%). They had the lowest level of skills in database (41.8%).

Table 3 Levels of Actual IT Skills

Level of IT skills					Summary of scores	
None(%)	Below average (%)	Average (%)	Above average (%)	High (%)	Mean	S.D.
0.0	15.8	6.9	7.4	69.9	70.0	27.0

Table 4 Levels of Actual IT Skills for Selected Productivity Tools

Productivity tools	Level of IT skills					Summary of scores	
	None (%)	Below average (%)	Average (%)	Above average (%)	High (%)	Mean	S.D.
Word processing	0.0	0.0	0.6	10.1	89.3	18.2	2.3
Spreadsheet	10.1	4.5	8.8	5.1	71.5	22.1	10.5
Database	32.3	1.3	10.1	14.5	41.8	10.0	7.9
Presentation	24.1	0.0	2.5	3.8	69.6	12.2	7.1
Internet 26.6	0.6	8.2	15.2	49.4	7.4	5.0	

6.2 Objective 2: Knowledge about IT

As shown in Table 5, the majority of the participants had only average (47.4%) and above average (44.3%) knowledge about IT. The scores ranged from 6.0 to 24.0. The mean of correct responses was 13.7 (S.D.=3.9). The items measured were at the factual

Table 5 Levels of Knowledge about IT

Level of IT knowledge					Summary of scores	
None(%)	Below average(%)	Average (%)	Above average(%)	High (%)	Mean	S.D.
0.0	1.3	47.4	44.3	7.0	13.7	3.9

knowledge, comprehension and application levels according to the Bloom's Taxonomy (Bloom, 1956).

6.3 Objective 3: Attitudes toward IT

The total scores from four dimensions (usefulness, confidence, anxiety and aversion) were obtained to determine the degree of attitudes toward IT. Most of the participants' attitudes toward IT were highly positive (Table 6). The scores ranged from a low of 99.0 to a high of 169.0. The mean score of attitudes about IT was 139.7 (S.D.= 15.5).

Table 6 Degree of Attitudes Toward IT

Attitudes toward IT			Summary of scores	
Negative(%)	Positive(%)	Highly positive(%)	Mean	S.D.
0.0	15.8	84.2	139.7	15.5

Based on the results in Table 7, the majority of the participants found IT to be useful in improving the quality of their work (96.2%). They also had an acceptable level of confidence towards IT (60.1%). The results also indicated that most of them had low anxiety (71.5%) and aversion (79.1%). It can be, therefore, assumed that the participants were comfortable and liked using IT.

Table 7 Level of Usefulness, Confidence, Anxiety and Aversion Toward IT

Domains of attitudes	Degree of attitudes			Summary of Scores	
	Low(%)	Moderate(%)	High(%)	Mean	SD
Useful0.6	3.2	96.2	44.1	4.5	
Confidence	1.3	60.1	38.6	25.6	4.2
Anxiety	71.5	20.9	1.3	43.7	7.1
Aversion	79.1	20.9	0.0	26.2	3.2

6.4 Objective 4: IT Preparedness

Scores of the three constructs (skills, knowledge and attitudes) were summed up to arrive at the composite measure of IT preparedness. Generally, most of them were highly IT prepared (69.0%) as seen in Table 8. The lowest composite score was 134.0 and the highest score was 289.0. The mean score of IT preparedness was 223.4 (S.D.=35.0).

Table 8 Level of IT Preparedness

IT preparedness level			Summary of scores	
Poor (%)	**Moderate (%)**	**Highly (%)**	**Mean**	**S.D.**
0.0	31.0	69.0	223.4	35.0

6.5 Objectives 6: Relationship between Selected Demographic Variables

The relationships between IT preparedness and age, teaching experience and prior computer experience were also ascertained. Teaching experience and prior computer experience were measured in terms of the number of years they had taught in schools and the duration they had been using computers respectively. Using the descriptors suggested by Guildford (1956), the correlations between IT preparedness and age, teaching experience and prior computer experience range from low to moderate but significant ($p < .01$) (Table 9). The correlations between IT preparedness and age, teaching experience were, however, negative.

Table 9 Correlations of IT Preparedness with Selected Demographic Variables

	IT preparedness (1)	**Age (2)**	**Teaching experience (3)**	**Computer experience (4)**
(1)	–	–.386**	–.411**	.384*
(2)		–	.893**	–.178**
(3)			–	–.127*
(4)				–

**. Correlation is significant at the .01 (2-tailed)
*. Correlation is significant at the .05 (2-tailed)

6.6 Objective 8: Tests of Differences

A hypothesis was tested for the significant differences between male and female participants in terms of IT preparedness. It was hypothesized there was a significant diference between the mean scores of IT preparedness for female and male participants.

Table 10 T-test for IT preparedness Scores between Female and Male Participants

Participants	Mean	t	df	Significance
Female	216.54			
	–5.969	250.733		.000
Male	238.36			

The mean score (238.36) of IT preparedness for male was higher than the mean for females (216.54) as shown in Table 10. This suggested that the male participants were more IT prepared compared to the female participants. The mean scores difference between male and female participants was 21.82. The value of the observed significance level (.000) was less than the .05 significance level. The null hypothesis was therefore rejected.

7.0 DISCUSSION

The proportion of female and male participants in this research was lopsided. There were more females compared to males who participated in this study. The teaching profession in Malaysia seems to be mainly dominated by females, therefore, this explains the relatively small numbers of males in this research. More than half of them have never taught in schools before while the rest have quite a substantial amount of teaching experience. All participants have received formal training in all the productivity tools before participating in the assessment.

Overall, the participants were found to possess a high level of IT skills where they scored highest in word processing. This result was satisfying especially after Ab. Rahim Bakar and Shamsiah Mohamad (1998) found that more than half of the Malaysian Vocational and Technology teachers who participated in the study did not know how to use word processing. They, however, scored the lowest in database. This could be possibly be contributed to the fact that word processing is the most commonly used application for these participants to prepare their semester assignments.

Based on the results in Table 5, it was concluded that the majority of them have average and above average knowledge of IT. A moderate positive correlation ($r = .44$; $p < .01$) was found between IT skills and knowledge about IT. While it seems reasonable that IT skills and knowledge about IT are related but no such cause and effect relationship can be established from this correlation result.

The participants reported positively high attitudes toward IT. Specifically, they found IT useful in enhancing the quality of their work as students. They also could work more efficiently with the help of IT. The moderate level of confidence they possessed showed that they were at ease using computers and software applications. With such characteristics, it was not surprising that they had low anxiety and low aversion.

With the three constructs (skills, knowledge and attitudes) summed up to represent IT preparedness, the data showed that the majority of participants were highly IT prepared. It can be concluded that pre-service teachers were equally IT prepared when compared to the in-service teachers as shown in the results from the study conducted by Wong et al. (2002).

There is a moderate negative relationship between IT preparedness and the following two variables: age and teaching experience. The older participants with more teaching experience were less IT prepared compared to the younger participants with less teaching experience. This could possibly be due to the reason that the younger participants were exposed to computers during their schooling days, there is also a moderate relationship but in positive direction, between IT preparedness and prior computer experience. The longer their prior computer experience, the more IT prepared they were. This result concurred with the findings of Liao (1993), Huang et al. (1995) and Wild (1995) who found that IT attitudes and skills were influenced by prior computer experience.

The study also found that males were better IT prepared than females. This hypothesis concurred with the research findings by Loyd and Gressard (1986), Blackmore et al. (1992) and Liao (1997) who found that males were more positive about IT than females.

8.0 CONCLUSION

The results of this study have thrown light on how IT prepared pre-service teachers are in Universiti Putra Malaysia. The teachers are only proficient in productivity tools that are commonly used in their daily lives such as word processing. It is alarming to know, however, that there are teachers who have no skills in the productivity tools tested despite undergoing formal training before they were assessed. This strongly signals that the IT training provided in this faculty must be relooked into to find out its effectiveness.

The results seem to indicate that there are two extreme groups, those who are highly proficient in using the productivity tools and those who are not proficient at all. The digital divide is evident among students in the same faculty even though they are exposed to the same facilities and IT training. This could possibly be that those who are highly proficient have prior computer experience compared to those who are not. The present study, therefore, indicated that teachers' prior computer experience plays a crucial role on their IT preparedness. Overall, the level of teachers' IT skills is high but the same cannot be said when the skills level is seen according to the types of productivity tools.

It is important to note that most of them are knowledgeable about IT and have very positive attitudes toward IT. With the teachers' attitudes being highly positive toward IT, they will most likely be more motivated to use IT in the classrooms. Liaw (2002) argued that how effective the implementation of technology would depend very much on the users' attitudes toward it.

9.0 RECOMMENDATIONS

Based on the results of this research, we recommend that pre-service teachers who are still not proficient in IT after undergoing a compulsory basic IT course should be given remedial courses. In addition, IT courses should be taught according to the pre-service teachers' level of IT preparedness and their prior computer experience. Evidence from this study indicated that pre-service teachers' prior computer experience played a pertinent role on their IT preparedness. Perhaps, providing appropriate computer experiences to teachers could help improve their IT preparedness.

It is also recommended that more emphasis should be given to productivity tools such as spreadsheet and database. Less emphasis should be given to productivity tools such as word processing as evidence from this study and those conducted overseas clearly show most students are proficient in using the word processor.

10.0 LIMITATIONS OF THE STUDY

The following scopes of this study need to be recognised and acknowledged. The Microsoft Office Package was used as a platform to test the teachers' skills. This package is used in UPM where the study was carried out. The results of the skills' test, therefore, cannot be generalised beyond this software package. Serious consideration should be given to the motivation of all participants who were involved in the instrument development. This is because there was no vested interest for this sampling group that would ensure that every participant took the testing process seriously. The participants, however, were strongly encouraged by the course instructors to participate in this study. The researcher rewarded each participant with a free diskette at the end of each session as a token of appreciation.

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