

**MEASURING LEARNING OUTCOMES FROM
COMPUTER USAGE AMONG MATHEMATICS,
SCIENCE AND ENGLISH LANGUAGE TEACHERS**
*(MENILAI HASIL PEMBELAJARAN DENGAN PENGGUNAAN
KOMPUTER DALAM KALANGAN GURU MATEMATIK,
SAINS DAN BAHASA INGGERIS)*

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Abstract

This was a survey research which investigated the important issues concerning computer use among fresh graduated teachers from teacher training colleges in Sabah. The first issue was concerned with the levels of Learning Outcomes (LO) and computer usage (CU) and its factors. The second was concerned with the effects of Learning Outcomes on computer usage. The final was concerned with moderating effect of school environment (SE) on relationship between Learning Outcomes towards computers usage. A set of questionnaire was used as the research instrument and stratified systematic sampling was used to determine the research samples. The samples consisted of 192 primary and secondary school teachers. The data were analyzed using descriptive and inferential statistics. Research hypotheses were tested at significance level of $\alpha = 0.05$. The findings showed that fresh graduated teachers have high in LO and moderate in CU. Gender and frequency or computer access at home were significantly related to the levels of learning outcomes and computer usage among teachers. LO had significant effects on computer usage. SE has moderating impact on the relationships between LO towards computer usage. In short, the study provided wider implications for theory development, practices and policymaking that can be associated with the computer usage among teachers. As a whole, most of the theoretical rationales used in explaining those relationships have been supported.

Keyword Learning outcomes, computer usage, mathematic teacher, science teacher, language teacher

Abstrak

Kajian ini merupakan suatu kajian survey yang meneliti isu penting berkaitan dengan penggunaan komputer di kalangan graduan di maktab perguruan di Sabah. Isu pertama adalah berkaitan tahap hasil pembelajaran (HP) dan penggunaan komputer (PK) dan faktornya. Kedua kajian adalah berkaitan kesan HP dengan PK. Isu terakhir berkaitan kesan penyederhanaan suasana sekolah terhadap hubungan antara HP dengan PK. Soal selidik digunakan sebagai alat penyelidikan dan kaedah persampelan sistematik berlapis digunakan untuk menentukan sampel kajian. Sampel kajian terdiri daripada 192 guru dari sekolah rendah dan menengah telah mengambil bahagian dalam kajian ini. Data dianalisis menggunakan kaedah deskriptif dan statistik taabiran. Hipotesis kajian diuji pada aras keertian $\alpha = 0.05$. Dapatan kajian menunjukkan guru pelatih telah mencapai tahap HP yang lebih tinggi dan PK yang sederhana. Jantina dan tahap penggunaan komputer di rumah adalah signifikan dengan tahap HP dan PK. HP mempunyai kesan signifikan dengan PK. Suasana sekolah mempunyai kesan penyederhana terhadap HP dengan PK. Pendak kata, dapatan kajian ini memberi implikasi yang besar terhadap perkembangan teori, pengamal dan pembentukan dasar yang berkaitan dengan penggunaan komputer di kalangan guru. Secara keseluruhannya, kebanyakan teori yang digunakan dalam menerangkan hubungan tersebut telah disokong.

Kata Kunci *Hasil pembelajaran, penggunaan computer, guru matematik, guru sains, guru bahasa*

INTRODUCTION

In this information Age, like other developed countries, there is a clear recognition that technologies can transform conventional education system and bring more advantages and benefits to Malaysians, especially for the younger generation, and the country as a whole (Serita Harian, 12 January 2004). Thus, Malaysian schools and colleges have included computer technology as an integral part of students learning experiences and as a way to equip them with the skills and knowledge necessary to succeed in the 21st century.

The push to incorporate and integrate technology in classroom teaching from all levels became much stronger and vital in Malaysian education system after the introduction of Smart School. The Smart School is one of the seven flagships applications underlying Multimedia Super Corridor (MSC) which began its operations in 1997. The objectives of the Smart School are to develop technology savvy individuals and eradicate computer illiteracy.

Such strategies began with RM150 million allocated for 1340 schools to develop their multimedia facilities and computer laboratories, thus paving the way for a revised school curriculum. Malaysia seeks to convert all its primary and secondary schools to smart schools by the year 2010 through one of the flagships championed by the MSC (Ministry of Education, 1997).

Moreover, the Malaysian government has established various institutions, such as the National Information Technology Council (NJTC), the Malaysian Institute of Microelectronics Systems (MJMOS), the Communications and Multimedia Commission (CMC) and the Multimedia Development Corporation (MDC) to encourage the use of computer related technologies in the Malaysian society (Tipton, 2002). In line with this, billions of Ringgits have been poured into the educational sector to acquire necessary equipment.

Besides that, Ministry of Education (MOE) has pooled leading consortia, such as Time Engineering, Microsoft Malaysia, Prestariang Technology Sdn. Bhd. and Intel Malaysia to ensure the success of computer implementation in educational programs. These consortia have played vital roles in preparing healthy environment to advance communication and cooperation among teachers towards enhancing technological knowledge. As of December 2004, Intel has trained more than 27,000 teachers locally (The Star, 24 April 2005). Trainers in the Intel programs had used "teachers teach teachers" concept where teachers who have undergone the training will train their peers after returning to their own workplaces or schools.

Based on the data from Sabah Education Department (Infonnation Unit), in Sabah alone, within 54 months (4 years 6 months), 14,760 notebooks and 9,987 uni1s of LCD projectors had been distributed to primary and secondary 1eachers. From the year 2003 to June 2007, the Ministry ofEducation has spent about RM 15 millions to purchase computer related equipment for Mathematics, Science and English teachers in Sabah which is underlies the Pengajaran dan Pembelajaran Sains dan Matematik menggunakan Bahasa Inggeris (PPSMI) program.

Table 1 Total Computer Items Purchased for Mathematics, Science and English Teachers in Sabah (2003-June 2007)

Year	Item			
	Notebook (unit)	LCD (unit)	White Screen (unit)	Trolley/ speaker (unit)
2003	8,372	7,134	1,716	3,023
2004	593	1,242	1,237	3,022
2005	669	16	11	30
2006	1,396	117	3,204	3,209
June 2007	3,730	1,478	1,578	2,919
Total	14,760	9,987	7,735	12,173

STATEMENT OF PROBLEM

Millions of Malaysian Ringgit has been spend on educational technology in teacher educational programs. This is to equip them with a pool of computer skills, knowledge and attitudes, and simultaneously ensure higher level of computer usage before they are posted to schools. However the question, "How far the effectiveness of teacher educational training programs (learning outcomes) can increase the level of computer usage among teachers and what are the factors influencing it?" has become the byword for ineffectiveness. Presently, there are limited studies that focus on how learning outcomes and school environment influence the usage of computers either in instructional or non-instructional teaching methods and its levels. The lack of information regarding factors contributing to the usage of computer has led to teacher educators to deliver knowledge insufficiently and ineffectively enough to encourage teachers to use computers in their teaching and learning. Many teacher educators are unsure of the effectiveness of the program, especially in encouraging teachers to integrate computer in their teaching and learning.

OBJECTIVES OF THE STUDY

1. To examine the factors influencing learning outcomes and computer usage, and its levels among fresh graduates from teacher training colleges based on the selected demographic and personal background.
2. To examine the relationship between learning outcomes and computer usage among fresh graduate teachers from teacher training colleges.

3. To examine the effects of school environment (administrators and technical support), as moderated variable, in the relationship between learning outcomes towards computer usage among fresh graduate teachers from teacher training colleges.

REVIEW OF RELATED LITERATURE

Gender and Computer Usage

Studies of the relationship between gender and computer attitudes and computer usage have produced mixed results. Many studies (Sanders, 1984; Loyd & Gressard, 1986; Massoud, 1991) have that shown there were significant differences in computer use based on gender.

Sander (1984) noted that most female teachers prefer human rewards (not machine rewards, such as computer) and the level of computer usage among females were relatively low compared to the male teachers. Female individuals have more negative attitudes and perceptions about using computers than their male counterparts. Females have also traditionally been less interested than males in pursuing careers in highly technical areas. Sander's findings had been supported by other researchers, such as Loyd and Gressard (1986) and Massoud (1991). According to Loyd and Gressard (1986), the differences in male and female computer attitudes among public school teachers were found to be statistically significant and males held more positive attitudes towards computer than females. Massoud (1991) investigated adult students and found that males had a more positive attitude toward computers than females.

Computer Experience and Computer Usage

Jintavee (2005) had done the study on technology preparation in teacher educational programs at three selected public universities, Chulalongkorn University, Kasetsart University and Srinakharinwirot Univeristy in Bangkok. The results from the regression analyses have shown that computer experience has statistical significance with the perceptions of knowledge and skills towards computer usages. Park (2003) built a model based on Theory of Planned Behavior (TPB), Technology Acceptance Model (TAM) and Roger's adoption model and incorporated seven variables from three perspectives (personal characteristics, perceived attributes of innovation, perception of influence and support from the environment). It also indicated that computer experience was the important predictor for the level of Webassisted Instruction.

He also added that teachers' previous experiences in using the computer played an important role in their perception of their capability to use the internet.

In Kumar and Kurma (2003) study, a marked dichotomy was found between faculty members with differing amount of computer experience. He found that members with low technology experience engaged in more traditional pedagogical practices and found it more difficult to assimilate computer knowledge into their teaching and learning styles.

Access to Computer at Home and Computer Usage

Many studies indicated that access to computer at home is also an important factor that influences the level of computer attitudes and computer use among teachers. Frequent access to the computer at home has an impact on the use of computer for teaching and learning. Many researchers, such as Campbell (1986, 1989), Becker, Ravitz and Wong (1998), Levine and Donitsa-Schmidt (1998), Ahmad (2000), Javeri (2003) agreed that there was a significant difference in the access to computer at home and computer use among teachers.

Campbell (1986), cited in Eyadat (2006), recorded and concluded that there was a significant difference between computer use and owning a computer at home. Teachers with computer at home showed a higher positive attitude toward computer use than those without a home computer. Campbell also noted that gender factor was significant for home computer ownership and school computer used. Campbell's (1986) research also supported that frequent use of computer at home resulted in a low computer anxiety score. Campbell (1989), in another report, detected that more males than females had access to home computers. Besides, Levin and Gordon (1989) showed that owning computer at home and using it made students more motivated and confident about computers, and more positive about the need for computers.

Becker et al. (1998), in their study, concluded that the majority of primary teachers were not assigning technology based assignment to their students with much regularity or frequency. He continued that, only one out of six Science teachers, one out of eight social studies teachers and one out of nine mathematics teachers used computer in their classroom frequently. From the findings, Becker et al. (1998) concluded that access to computer was an important determinant of whether a teacher uses computer frequently with the students. From the results of their analysis, they found that usage of computers was significantly positive with the number of access to computer, whether at home or school. Levine and Donitsa-Schmidt (1998) also support the idea of the association between frequent access to computer and computer usage in classroom.

Ahmad (2000) conducted a study to examine the perceptions of teachers regarding the use of computer in their classrooms. According to the data collected, there was a significant relationship between frequent access to the computer and the use of computer in the classroom. For teachers with access to computer at home, they shared more positive attitudes towards computer than their counterparts. Teachers who access to computer at home frequently also reported less computer anxiety, more confidence, more computer liking and more perception of computer usefulness.

Javeri (2003) indicated that, at some point in the innovation adoption, inadequate access to technological infrastructures may bring difficulties in integrating the computer in classrooms. Javeri's study showed that teachers, who hesitated and were reluctant to use technology, had higher anxiety and fear towards computer and they tended to require more support from peers. Javeri's findings were in line with other researchers, such as Russell et al. (2003).

Learning Outcomes and Computer Usage

Today, educational stakeholders demand constant evaluation and assessment among trainee teachers while they are in the teacher training colleges and it becomes the heart of the teacher training policy to ensure that all trainee teachers are equipped with high learning outcomes as the means to ensure that broad principles and major facts taught in the classroom can be learned, retained and applied after they have been posted to the schools.

Many famous researchers on training transfer, such as Goldstein and Ford (2002) and Baldwin and Ford (1988), had hypothesized that the more positive the learning outcomes or what trainees have learnt, the more likely the trainees would transfer knowledge and skills to the job which was previously learned in training. All those studies have found to be significantly added to the explained variance in the degree of transfer and it provides support for the idea that individuals who learned more in training are more likely to transfer what they have learnt to the actual working environment.

Goldstein and Ford (2002) had proposed a model of characteristics affecting learning and transfer outcomes which further demonstrate links between critical areas necessary for transfer outcome or actual outcomes. As shown in Goldstein and Ford's (2002) model (Figure 1), learning outcomes have significant impact or influence on the transfer outcomes. Moreover, from the model, it showed that workplace (working environment) acted as the moderator variable in between learning outcomes and actual performance.

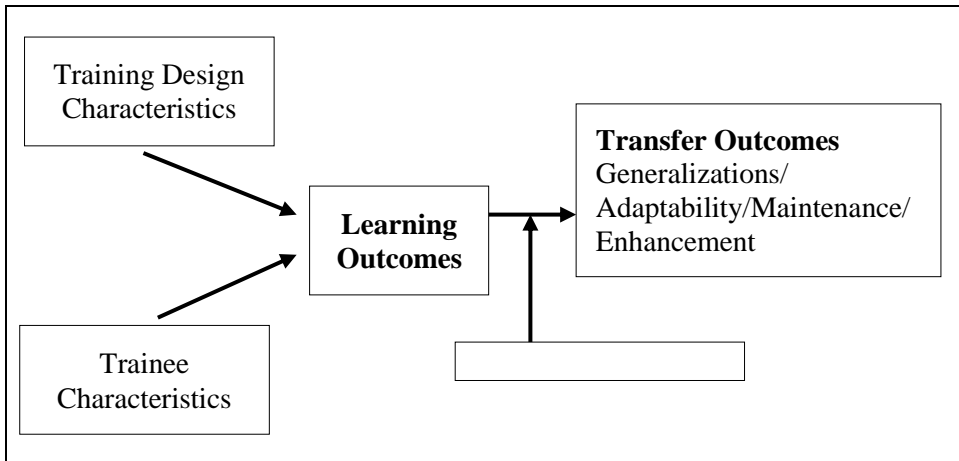


Figure 1 Model of Characteristics Affecting Learning and Transfer Outcomes

Besides Goldstein and Ford, Baldwin and Ford (1988) also surveyed the existing research on transfer or training and also developed a framework for examining transfer. According to them, the transfer process was described in terms of training input factors, training output and conditions of transfer. The researchers believed that training transfer could occur when there were positive learning outcomes. They noted that there was a direct significant relationship between training outcomes and the actual performance in any activities and tasks. This means, level of learning and retention can determine the level of training transfer. From the model of Transfer Process by Baldwin and Ford (1988) (Figure 2), it shows the link between training output and conditions of transfer. The training output or learning outcomes represent the results of the training (learning and retention). For transfer to occur, the trainee teachers must be able to generalize and maintain the material presented in the training class to their current school based setting and they must be able to maintain their knowledge base over a period of time. It is also named as Conditions of Transfer.

In order to examine generalization, one must be able to identify the knowledge, skills and behaviours that have been learnt and retained. Maintenance refers to the length of time that trained skills and behaviours continue to be used on the job in the workplace.

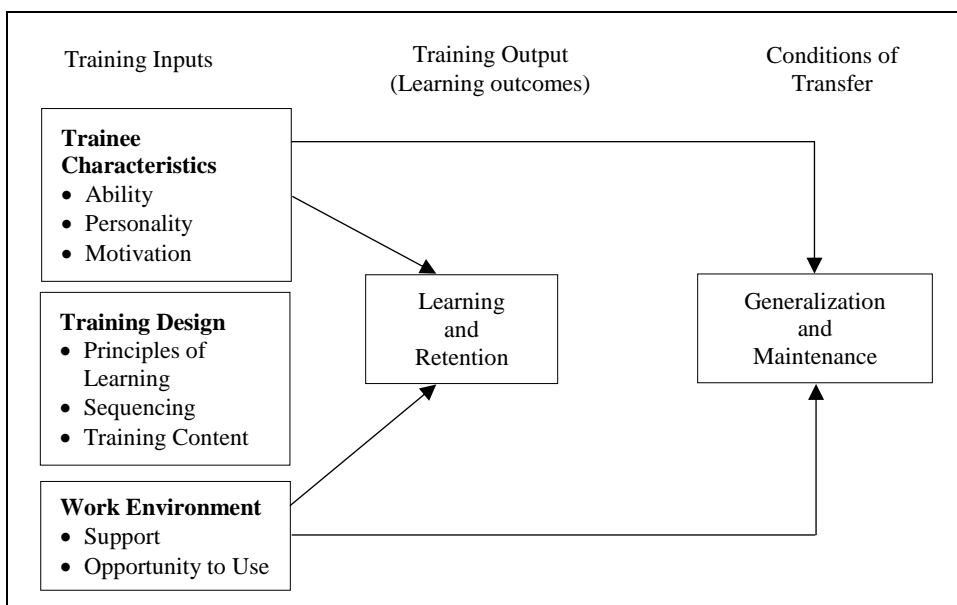


Figure 2 Model of the Transfer Process

Based on the literature review, it has been proven and explained that learning outcomes were vital to measure the actual performance. Trainees need to enhance enough knowledge or skills or attitudes in order to generalise that materials to their current school based setting and at the same time they must be able to maintain their knowledge or skills or attitudes over a period of time. This is because transfer must be anticipated, not left to chance and not limited to acquisition and application or skills, knowledge and attitudes.

School Environment and Computer Usage

Many researchers have conducted studies on the relationship between working environment and computer usage. The findings have shown mixed results where there was either a direct or indirect relationship between them.

Mitchell (2003) studied the computer use among 44 public high school educators in Westchester Country, New York which involved 250 teachers. From the study, she noted that teachers in high-technology environment possessed higher means in computer use than teachers in low-technology environment. Besides that, the findings also indicated that the principals' support variable was correlated, positively, strongly and significantly with the use of computer and frequency of computer use for planning, instruction, assessment and communication.

These findings confirmed the earlier studies done by Beeker (1999) who found that technical support to teachers was vital in influencing the use of computer by teachers. Furthermore, the researcher believed that the lack of sufficient on-site technical support might discourage teachers from using technology to its fullest potential although teachers have positive computer attitudes and self-efficacy. Ongoing adequate support was considered responsible for successful technology integration in school (Atkins & Vasu, 2000).

Another researcher, Thelma (2004) indicated that school support for computer integrations would format the positive computer attitude among teachers. He found that even though many teachers were optimistic about the computer use in classroom, they identified serious concerns about the support for computer activities. Pajares (2004) indicated that even with positive attitudes, teachers have difficulty embracing the expectation that the new technologies would be used effectively for their students and they found themselves faced with profound changes in teaching dynamics. These rapid changes can be overcome by having positive support from school. Motivation and encouragement from administrators and peer are vital in reducing the levels of resistant.

A study done by Green (2005) in examining the integration of computers into classrooms of schools in an urban school district also clarified that the lack of equipment could be construed as a barrier for teachers in using technology, as well as prevent the further integration of technology in creative and innovative ways.

Another survey study which was conducted in the southeast region of the United States with 202 special education teachers in 3 elementary schools by Barbetta (2006) proved that support from school environment was vital to maintain positive self-efficacy. Barbetta noted that under organizational issues, participants (teachers) wrote frequently about support from school administrators. Several responses by the language non-proficient (LNP) participants were in reference to having support from someone. The participants in the study had high efficacy scores and also viewed supervision and support from others as useful in their daily teaching activities.

Chan, Hong, Cllang and Chu (2006) and Chan (2007) noted that the most important rating among teachers regarding the factors influencing the integration of computer in school was the school environment, especially hardware and software facilities. Their findings have confirmed the study done by Wilson and Notar (2003) where they believed that the on going investment on hardware and software in schools was always essential to promote technology integration and it was emphasized to most teachers that school environment could change teachers' belief and attitude towards computer use (Chan, 2007).

Computer Usage

Generally, the researcher believed that the justification of computers usage among teachers is primarily driven by a teacher's work task. Even though, nowadays the teachers' tasks and responsibilities may vary but base on literature review of Reynolds et al. (1992) in the field of teaching, there are some common teaching related tasks that can be used to measure the use of computer among teachers. The study noted that teaching task can be categorized as pre-active, interactive, and post-active or learning. Reynolds labeled tasks, such as comprehending, preparing and adapting content, plans and materials as pre-active; those tasks performed during instruction as interactive; and tasks that demonstrated reflection on one's own actions and student's responses, interacting with colleagues and continued professional development as post-active. Using part of Reynolds' et al. (1992) design, they identify that teachers, basically have six tasks. These were identified as, planning for a preparing instruction; managing the classroom; implementing instruction; evaluating student learning and instructional effectiveness; administrative responsibilities; and additional professional responsibilities.

In this study, computer use was divided into planning, instruction, assessment and communication. Rosenfeld's first task analogous to this study's planning component. Rosenfeld's second and third tasks were subsumed in this study's instruction component. The assessment component corresponded perfectly to Rosenfeld's fourth task and finally, in so much as communicating with parents, students and colleagues were part of one's additional professional responsibilities as a teacher and this was included as part of Rosenfeld 's fifth and sixth tasks.

Based on the above literature reviews, the researcher has hypothesized that learning outcomes have significant relationship and impacts on the computer usage among fresh graduates from teacher training colleges in Sabah. It was also hypothesized that the relationship was moderated by school environment. Figure 3 shows the research model for this study.

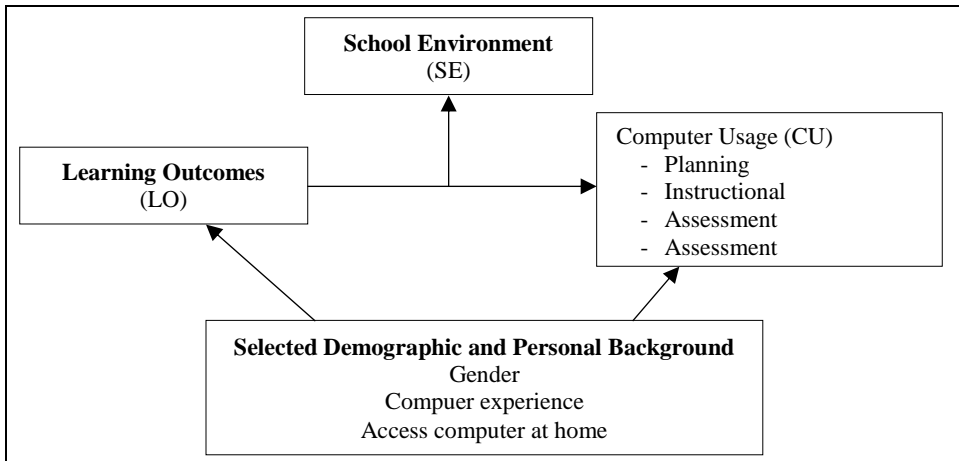


Figure 3 Research Model and Hypotheses

The hypotheses of this study are as follows:

- H1 There are significant differences in means of learning outcomes (LO) and computer usage (CU) based on selected demographic and personal background among fresh graduates from teacher training colleges.
- H2 Learning Outcomes (LO) have positive correlation with computer use (CU).
- H3 The relationships between learning outcomes toward computer use is moderated by school environment.

METHODOLOGY

This study required the development and adoption of questionnaire designs that would facilitate the collection of data concerning use of computer among fresh graduates from teacher training colleges. Data regarding teachers' learning outcomes and school environment were collected based on the self-administered method via questionnaire.

The population of this study consisted of fresh graduate teachers from teacher training colleges namely, Gaya Teacher Training College, Keningau Teacher Training College, Kent Teacher Training College, Sandakan Teacher Training College and Tawau Teacher Training College in Sabah. Based on stratified systematic sampling, researcher sent 529 questionnaires. A total of 236 reminder letters were sent out and 219 questionnaires were returned.

The response rate of the final number of usable questionnaires, excluding the cases of outlier, samples who did not have computer at home and mistakes in filling, was 36.29 percent ($192/529=36.29\%$) or total of 192 samples.

The statistical methods used for data analysis in this study were Descriptive Statistic and Inferential Statistic. The descriptive analysis was used in this study to analyze the levels of learning outcomes and computer usage among fresh graduates from teacher training colleges. The inferential statistic was a basic tool of statistical tests for the hypotheses. The measurements for this study were namely regression analyses (Hierarchical Regression Analysis) via SPSS Version 11.5 for Windows.

RESULTS

Profile of Respondents

The results indicated that there were more female respondents than male respondents. Out of the total 192 respondents, 62.5% were female and the others were male (37.5%). In relation to the age of the respondents, the analysis showed that majority (48.4%) of the teachers were around 26 to 30 years old and were followed by those within the range of 21 to 25 (31.1%). Out of the 192 respondents, only 20.3 percent of the samples were above 31 and below 35 of age. Most of the respondents who have taken part in this study were Malays (71.9%) while the other races were the least.

In terms of their major subjects, Science subject was the most if compared to other subjects, Mathematics and English. From the result, it had been shown that 41.7 percent majored in Science, while English and Mathematics had 33.3 percent and 25 percent respectively.

From the samples, over 42.2% of the respondents were teaching in primary school and 57.8% were teaching in secondary schools. From the 42.2% of primary school teachers, 24% were teaching Year 1 until 3 and the rest were teaching Year 4 until 6. Besides, the data also indicated that most of the respondents were teaching Form 1 until Form 3. The data showed that 32.3% and 25.5% were lower primary and upper school teachers respectively. From the above data, it has been shown that the samples were normally distributed from lower primary until upper secondary schools.

Descriptive Analysis

As shown in the Table 2, a total of 52.1% of the respondents had high learning outcomes. The result of the research has shown that only 9.9% or 19 respondents out of 192 respondents had high level of computer usage. Overall, the fresh graduates from teacher training colleges have achieved the moderate level in learning outcomes from computer usage as indicated by the mean.

Table 2 Distribution of Learning Outcomes and Computer Usage Levels

Predictor	Level (range of score)	Frequency	Percentage	Mean	Standard Deviation
Learning Outcomes	Low (15-30)	51	26.6	41.89	12.27
	Moderate (31-45)	41	21.3		
	High (46-60)	100	52.1		
Computer Use	High (12-31)	71	37.0	37.68	10.37
	Moderate (32-52)	102	53.1		
	High (53-72)	19	9.9		

Besides knowing the levels of learning outcomes and computer usage, the researcher also analyzed the percentage of the frequency of computer use among teachers based on the ways of computer been used (planning, instructional, assessment and communication). From Table 3, 32.1% of the respondents used computer for planning purposes, followed by instructional (23.7%), and communication (22.45%). Computer use for assessment purposes was the lowest with only 21.66%.

Table 3 Distribution of Ways of Computer Use

Ways of Computer Use	Percentage
1) Planning	32.1%
2) Instructional	23.7%
3) Assessment	21.66%
4) Communication	22.45%

Inferential Analysis

a) Hypothesis 1

There are significant differences in means of learning outcomes (LO) and computer use (CU) based on selected demographic and personal background among fresh graduate teachers from teacher training colleges.

H1 (a) There are significant differences in means of learning outcomes and computer use based on gender.

The findings of this study had shown that male teachers have higher means for learning outcomes and computer use. Through the t-test, the Levene's test Equality of the variances has indicated that learning outcomes have equal variances assumed but computer use have equal variances not assumed.

From Table 4, the results have indicated that male teachers have higher level of learning outcomes and computer use compared to female teachers. Thus, Hypothesis 1 (a) was accepted.

Table 4 Means of Learning Outcomes and Computer Use Based on Gender

Variable	Gender	mean	Std Deviation	df	t	Sig – t
Learning Outcomes	Male	3.2458	0.6792	165.02	2.419	0.017
	Female	2.9875	0.7743			
Computer Use	Male	3.4583	0.8977	190	2.909	0.05
	Female	3.0944	0.8021			

H1 (b) There are significant differences in means of learning outcomes and computer use based on computer experience.

An Analysis of Variance test (ANOVA) was applied to measure any differences in learning outcomes and computer use based on years of computer experience. Table 4.8 shows the results from the ANOVA analysis.

Table 5 Means of Learning Outcomes and Computer Use Based on Computer Experience

Variable		Sum of Squares	F	Sig.
Learning Outcomes	Between Groups	3.511	2.124	0.990
	Within Groups	103.602		
	Total	107.113		
Computer Use	Between Groups	5.000	2.325	0.076
	Within Groups	134.749		
	Total	139.749		

From the findings, it has been proved that learning outcomes and frequency of computer use among teachers were not influenced by computer experience. Based on the analysis, Hypothesis 1 (b) was rejected.

H1 (c) There are significant differences in means of learning outcomes and computer use based on frequency of computer access at home.

Table 6 had shown the results of the differences in means of learning outcomes and computer use based on frequency of access computer at home.

From the analyses, it has been shown that all four main independent variables namely computer attitudes, computer teaching efficacy, learning outcomes and computer use were significant at $p < 0.01$. Thus, the Hypothesis 1 (c) was accepted.

The multiple comparisons results by Post-Hoc Tukey HSD for the difference in mean for learning outcomes and computer use based on the frequency of computer access at home has been shown in Table 7. Overall, the results have indicated that teachers with high level of computer access at home have scored higher mean for learning outcomes and computer use if compared with the lower level of access computer at home.

Table 6 Means of Learning Outcomes and Computer Use Based on Frequency of Computer Access at Home

Variable		Sum of Squares	F	Sig.
Learning Outcomes	Between Groups	37.709	24.784	0.000
	Within Groups	95.348		
	Total	133.057		
Computer Use	Between Groups	41.021	26.038	0.000
	Within Groups	98.728		
	Total	139.749		

Table 7 Post-Hoc Tukey HSD for Learning Outcomes and Computer Use Based on Computer Access at Home

Dependent Variable	Frequency	N	Mean	Never	Occasionally	Sometimes	Frequently
Learning Outcomes	Never	2	2.450	-	-.313	-.566	-.955
	Occasionally	67	2.763	.313	-	-.253	-.642* (p<0.000)
	Sometimes	45	3.016	.566	.235	-	-.390* (p<0.016)
	Frequently	78	3.405	.955	.642* (p<0.000)	.390* (p<0.016)	-
Computer Use	Never	2	2.375	-	-.279	-.945	-1.32
	Occasionally	67	2.654	.279	-	-.666* (p<0.000)	-1.042* (p<0.000)
	Sometimes	45	3.320	.945	.666* (p<0.000)	-	-.376* (p<0.031)
	Frequently	78	3.697	-1.323	1.042* (p<0.000)	.376* (p<0.031)	-

b) *Hypothesis 2*

Learning Outcomes (LO) have positive correlation with computer use (CU).

Based on Table 8, learning outcomes variable was found to have significant relationship or impact on computer use among fresh graduate teachers from teacher training colleges but there was very low impacts on the use of computer among teachers. The results indicated that only 11.2% variance of computer use can be explained by the learning outcomes variable, with beta coefficients 0.39 at 0.01 significant level. From the result, it can be gathered that although trainee teachers have learnt whatsoever knowledge and skills that were taught in the teacher educational program, it could not guarantee that the teachers would have higher frequency of computer use in the real environment. The complexity of using computer technology as a medium to deliver knowledge to students should be examined to ensure that the knowledge and skills that have been learnt in teacher educational program can benefit to teachers. In this study, Hypothesis 2 was accepted.

Table 8 Results of Regression Analysis between Learning Outcomes and Computer Use

Independent Variable	Unstandardized Coefficients		Standard Coefficients	t
	B	Std. Error	Beta	
Learning Outcomes	.383	.078	.335	8.285**
R – square			.112	
Adjusted R – square			.107	
F – value			23.949	
Sig – F			.000	
Durbin – Watson			1.585	

* $p < 0.05$; ** $p < 0.0$

c) *Hypothesis 3*

The relationship between learning outcomes (LO) and computer use (CU) is moderated by school environment (SE).

The following regression was carried out to determine the impact of school environment as the moderator toward the relationship between learning outcomes and computer use among fresh graduates from teacher training colleges. The results of the analyses were depicted in Table 9.

From Table 9, it can be seen that there was significant change in R-square when the interaction terms were added to the regression analysis in step 3. The R square change was about 3.1% and the F-change statistics was significant, indicating that the school environment has moderated the relationship between learning outcomes and computer use.

The moderating impact was also proven by the result from the interaction between learning outcomes and the moderator itself ($b=281$, $p<0.01$). Thus, the hypothesis which stated that the relationship between learning outcomes and computer use was moderated by school environment was fully accepted in this study.

Table 9 Moderating Impact of School Environment on the Relationship between Learning Outcomes and Computer Use

Independent Variable	Beta (Step 1)	Beta (Step 2)	Beta (Step 3)
Main Variables			
Learning Outcomes	0.383**	0.338**	-0.492
Moderating Variable			
School Environment		0.206*	-0.575
Interaction Terms			
Learning Outcomes *Moderator			0.281**
R square	0.112**	0.130	0.161**
R square change	-	0.018	0.031
Sig. F change	0.000	0.048	0.009
Durbin Watson	1.553		

** $p<0.01$

To see the impact of moderation, the researcher has plotted a graph as shown in Figure 4. The variables were re-categorized into two levels, high and low using a median split before the graph was drawn. The graph shows that the school environment has very high impact on the relationship between learning outcomes and computer use.

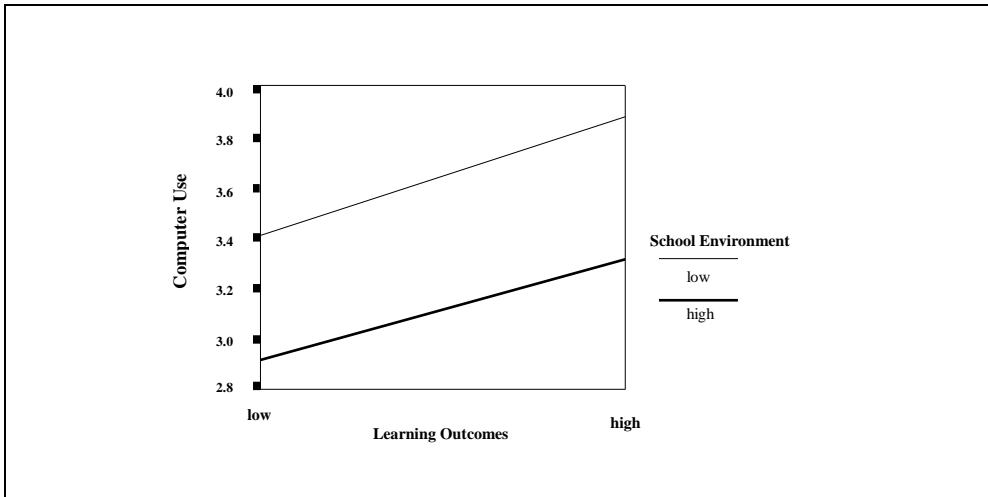


Figure 4 The Moderating Effect of School Environment on the Learning Outcomes and Computer Use

IMPLICATIONS AND RECOMMENDATIONS

Emanating from the findings and conclusions, the implications derived succeeded by recommendations are presented as follows:

Learning Outcomes

The discovery of the importance of learning outcomes towards the actual performance by the previous studies has been proven that learning outcomes is the predictors for computer use. But, the results gathered from this study contradicted the previous findings. The findings showed that learning outcomes was not a good predictor (weak relationship) and it can be eliminated from the suggested conceptual framework. Many previous studies have noted that by improving level of learning outcomes, it will definitely improve the actual use. Henceforth, in this regard, it is very important to take a constructive step to identify the root of the problems which lead to the statistically insignificant relationship between learning outcomes and computer use among fresh graduates from teacher training colleges in Sabah.

The ineffectiveness in the implementation and irrelevant syllabi and level of complexity that are taught in the teacher educational program might be one of the reasons that lead to the respective results.

Although the descriptive data has shown that 52.1% of the respondents scored high level of learning outcomes, only 9.9% of them achieved high level of computer use in school. The knowledge and skills that have been learnt in teacher education might not be practical or sufficient enough for teachers to deliver knowledge via computers. The knowledge and skills on integration of computer in teaching and learning should be examined to ensure that it is beneficial to the teachers.

This early indication and realization will help policymakers and teacher's educators in developing a better and more comprehensive approach toward educational technology, especially in designing the curriculum for teacher educational program. Updating the National Educational Technology Standards in teacher educational programs from time to time is vital as technology continue to grow and develop rapidly, especially in this Information Age. It serves as guidelines to prepare and update courses for pre-service and in-service teachers for appropriate knowledge and effective use of computer in teaching and learning.

Besides that, pre-test and post test for all the trainee teachers are essential in teacher educational programs. The pre-test would benefit the programs in that it could instill better plan for curriculum preparation, especially papers that related to technology integration, instead of replicating knowledge and skills the students already possess. Dy identifying trainee's needs, the programs will be more beneficial to the trainee teachers. Also, the post-test might be able to indicate the effectiveness and efficiency of the technological preparation in the teacher educational programs.

School Environment

It was also conclusively reported that school environment has moderating impact on the relationship between learning outcomes and computer use. The significance of school environment in enhancing the relationship between learning outcomes and computer use could be due to the fact that teachers need administrative and technical support to encourage them to use the computer. Teachers need strong and enthusiastic leadership from principal in order to achieve higher confidence and belief in the use of computers. Technical support is vital when teachers are having difficulties in operating the computer based technologies equipment. Having knowledgeable people and willingness to answer questions are critical in overcoming the obstacles to use computer. In the Malaysian schools, especially in the rural areas, lack of availability of computers and software, and incompatibility between the software and hardware are very common situations where most teachers may know how to 'operate' a computer but do not know or understand its benefits.

Training for principals is vital in ensuring that they are conscious of the importance of computer in teaching and learning. Through training, they would be able to know how to encourage (giving coaching, feedbacks and leading) teachers to use computers.

Many teachers have voiced out that the number of computers in their classrooms was insufficient. Lack of equipment could be construed as a barrier for teachers in using technology, as well as to further integration of technology in creative and innovative ways.

School districts should look for different funding resources to make computer technologies available for each teacher and in each classroom. Principal or headmasters should give motivation and support to their staff and encourage them to use computer although at the initial level it could be very difficult.

LIMITATIONS OF THE STUDY

Among the limitations identified in the study were the population of this study is only teachers either major or minor in Mathematics, Science or English Language. Therefore, the findings derived from the analyses might not adequately reflect the perceptions of the whole population of teachers graduated from teacher training colleges in Sabah and Malaysia as a whole and the questionnaire used in this study may not be able to measure all aspects for the variables concerned. Cultural bias will be assumed in this study and subject to its weaknesses.

CONCLUSIONS

This study has concluded that gender and frequency of computer access at home have significant impacts on levels of learning outcomes and computer use among fresh graduated teachers from teacher training colleges in Sabah. Learning outcomes also found to have statistically significant relationship to the computer use among teachers. In this study, the researcher also discovered that school environment has mediating impacts on the relationship between learning outcomes towards computer use. In short, the study provided wider implications for theory development, practices and policymaking that can be associated with the computer use among teachers. As a whole, most of the theoretical rationales used in explaining those relationships have been supported.

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