UNIVERSITI PUTRA MALAYSIA

PREDICTORS OF LAPTOP USE IN TEACHING AND LEARNING AMONG SECONDARY SCHOOL MATHEMATICS AND SCIENCE TEACHERS

PRISCILLA MOSES

FPP 2012 66
PREDICTORS OF LAPTOP USE IN TEACHING AND LEARNING AMONG SECONDARY SCHOOL MATHEMATICS AND SCIENCE TEACHERS

By

PRISCILLA MOSES

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirement for the Degree of Doctor of Philosophy

February 2012
I am truly grateful for all your love, care, guidance and support.

For all that you are,
I love you both so much!
Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Doctor of Philosophy

PREDICTORS OF LAPTOP USE IN TEACHING AND LEARNING AMONG SECONDARY SCHOOL MATHEMATICS AND SCIENCE TEACHERS

By

PRISCILLA MOSES

February 2012

Chair : Wong Su Luan, PhD
Faculty : Faculty of Educational Studies

With the growing emphasis on technology, Mathematics and Science teachers were provided with laptops as an instructional tool to improve their lesson delivery. The focus of this study was to investigate the factors that influence the use of laptops in the teaching and learning among the secondary school Mathematics and Science teachers. The predictor factors were laptop competence, perceived ease of use, perceived usefulness, attitude towards laptop use, administrator’s support, and technical support.

This study was based on a quantitative descriptive research using a set of questionnaire. The validity of the instrument was established through a panel of experts. Pilot test was carried out among 38 teachers and the Cronbach’s
alpha coefficient value was found to range from .731 to .978. The respondents of this investigation were secondary school Mathematics and Science teachers from the Central Region of Malaysia. The total sample of Mathematics and Science teachers was 473. Descriptive statistics and Structural Equation Modeling using SPSS and AMOS was employed in this study.

Several significant findings emerged from this study. The results attained from the analysis generated a model — the Malaysian Teachers’ Laptop Use Model (MyTeLUM) that could be used to predict the use of laptops among the Mathematics and Science teachers for teaching and learning. The significantly emerged paths were: 1) laptop competence influenced perceived usefulness ($\beta = .184, p < 0.05$); 2) perceived ease of use influenced perceived usefulness ($\beta = .451, p < 0.001$); 3) perceived usefulness influenced attitude ($\beta = .691, p < 0.001$); 4) perceived usefulness influenced laptop use ($\beta = .256, p < 0.001$); 5) attitude influenced laptop use ($\beta = .481, p < 0.001$); 6) technical support influenced perceived ease of use ($\beta = .193, p < 0.001$); and 7) technical support influenced perceived usefulness ($\beta = .119, p < 0.05$). However, only administrator’s support ($\beta = 0.022, p > 0.05$) was found to be insignificant in predicting the use of laptops among the teachers. In addition, two new additional paths that were statistically significant were also identified from the MyTeLUM. The first path showed that laptop competence predicted perceived ease of use ($\beta = .623, p <
0.001) and the second path that emerged showed that technical support influenced laptop competence ($\beta = .199, p < 0.001$).

Meanwhile, the four mediating variables identified in this study were perceived ease of use, perceived usefulness, attitude towards laptop use, and laptop competence. Three of the intervening variables acted as partial mediators, except for the perceived usefulness which played the role of a total mediator between the variables. Furthermore, the MyTeLUM yielded dissimilar results on the influence of the variables for Mathematics (technical support on perceived usefulness; $\beta = .128, p > 0.05$) and Science (laptop competence on perceived usefulness; $\beta = .000, p > 0.05$) subjects.

Out of the six predictors, five were found to be significant in influencing the use of laptop either directly (perceived usefulness and attitude towards laptop use) or indirectly (laptop competence, perceived ease of use, and technical support). Consequently, nearly half of the variance (46.7%) in laptop use was explained by the five variables for the teaching and learning.

This study proposes that greater emphasis should be placed on the teachers’ attitude towards laptop use and perceived usefulness in educating, preparing, and training the teachers to utilise the laptops for teaching and learning. Hence, the findings of this research may benefit and provide productive directions
especially to the Malaysian Ministry of Education as a laptop initiative policy maker in order to make the investment yield more effective results.
Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Doktor Falsafah

PERAMAL KEPADA PENGGUNAAN KOMPUTER RIBA DALAM PENGAJARAN DAN PEMBELAJARAN DALAM KALANGAN GURU MATEMATIK DAN SAINS SEKOLAH MENENGAH

Oleh

PRISCILLA MOSES

Februari 2012

Pengerusi : Wong Su Luan, PhD

Fakulti : Fakulti Pengajian Pendidikan

Guru Matematik dan Sains telah dibekalkan dengan komputer riba sebagai alat pengajaran untuk menambahbaikkan penyampaian pengajaran dengan penekanan yang semakin meningkat kepada teknologi. Fokus kajian ini adalah untuk mengkaji faktor yang mempengaruhi penggunaan komputer riba dalam pengajaran dan pembelajaran dalam kalangan guru Matematik dan Sains sekolah menengah. Faktor peramal adalah kompetensi komputer riba, persepsi kemudahgunaan, persepsi kebergunaan, sikap terhadap penggunaan komputer riba, sokongan pentadbir, dan sokongan teknikal.

Kajian ini adalah berdasarkan penyelidikan deskriptif kuantitatif yang menggunakan satu set soal selidik. Kesahan instrumen telah diperakui oleh vii

Beberapa penemuan yang signifikan telah didapati daripada kajian ini. Keputusan yang dicapai menerusi analisis yang dilakukan menghasilkan sebuah model — Malaysian Teachers' Laptop Use Model (MyTeLUM) yang boleh digunakan untuk meramalkan penggunaan komputer riba dalam kalangan guru Matematik dan Sains untuk pengajaran dan pembelajaran. Laluan signifikan yang dikenalpasti adalah: 1) kompetensi komputer riba mempengaruhi persepsi kebergunaan \((\beta = .184, p < 0.05)\); 2) persepsi kemudahgunaan mempengaruhi persepsi kebergunaan \((\beta = .451, p < 0.001)\); 3) persepsi kebergunaan mempengaruhi sikap \((\beta = .691, p < 0.001)\); 4) persepsi kebergunaan mempengaruhi penggunaan komputer riba \((\beta = .256, p < 0.001)\); 5) sikap mempengaruhi penggunaan komputer riba \((\beta = .481, p < 0.001)\); 6) sokongan teknikal mempengaruhi persepsi kemudahgunaan \((\beta = .193, p < 0.001)\); dan 7) sokongan teknikal mempengaruhi persepsi kebergunaan \((\beta = .119, p < 0.05)\). Walau bagaimanapun, hanya sokongan pentadbir \((\beta = 0.022, p > \))
0.05) sahaja yang didapati tidak signifikan dalam meramalkan penggunaan komputer riba dalam kalangan guru. Di samping itu, dua dapatan laluan baharu yang signifikan secara statistik telah dikenalpasti dari MyTeLUM. Dapatan pertama menunjukkan bahawa kompetensi komputer riba meramal persepsi kemudahgunaan ($\beta = 0.623, p < 0.001$) dan dapatan kedua yang diperolehi menunjukkan bahawa sokongan teknikal mempengaruhi kompetensi komputer riba ($\beta = 0.199, p < 0.001$).

Empat pembolehubah pengantaraan yang dikenal pasti dalam kajian ini ialah persepsi kemudahgunaan, persepsi kebergunaan, sikap terhadap penggunaan komputer riba, dan kompetensi komputer riba. Tiga daripada pembolehubah pengantaraan ini bertindak sebagai pengantara separa, kecuali persepsi kebergunaan yang memainkan peranan sebagai pengantara lengkap antara pembolehubah lain. Tambahan pula, MyTeLUM telah menghasilkan keputusan yang berbeza bagi pengaruh terhadap pembolehubah untuk mata pelajaran Matematik dan Sains (sokongan teknikal pada persepsi kebergunaan; $\beta = 0.128, p > 0.05$) dan Sains (kompetensi komputer riba pada persepsi kebergunaan; $\beta = 0.000, p > 0.05$).

Lima daripada enam peramal yang dikaji didapati signifikan dalam mempengaruhi penggunaan komputer riba sama ada secara langsung (persepsi kebergunaan dan sikap terhadap penggunaan komputer riba) atau tidak
langsung (kompetensi komputer riba, persepsi kemudahgunaan, sokongan teknikal). Maka, hampir separuh daripada varias (46.7%) dalam penggunaan komputer riba telah dijelaskan oleh lima pembolehubah untuk pengajaran dan pembelajaran.

Kajian ini mencadangkan bahawa penekanan yang lebih perlu diberikan kepada sikap terhadap penggunaan komputer riba guru dan persepsi kebergunaan dalam mendidik, menyediakan, dan melatih guru untuk menggunakan komputer riba untuk pengajaran dan pembelajaran. Seterusnya, dapatan kajian ini memberi manfaat dan arah tuju yang produktif khususnya bagi pihak Kementerian Pendidikan Malaysia sebagai pembuat dasar inisiatif komputer riba agar pelaburan yang dicurahkan membuahkan hasil yang lebih berkesan.
ACKNOWLEDGEMENTS

First and foremost, I would to thank my Lord Jesus Christ for making this possible. “You are the God who performs miracles” (Psalm 77:14). I thank the Lord for enabling me to successfully complete this study. It was His words and abundant grace that brought me thus far.

I am truly indebted and thankful to my advisor and supervisor, Associate Professor Dr. Wong Su Luan. She is a person whom I look upon to as a source of my inspiration. She is a scholar of very high standing. She is an erudite, attentive and enthuse person who has literally changed my life. She patiently trained me to acquire the skills and knowledge of a good quality researcher step by step. She consistently gave me the confidence to move forward in my studies with her words of wisdom. I believe it was her incessant guidance, advice, care and support that had motivated me to complete my studies successfully.

I am truly grateful to my co-supervisors, Professor Dr. Kamariah Abu Bakar and Dr. Rosnaini Binti Mahmud. There had been tremendous guidance, motivation and support from both of them throughout this study. Their wide-ranging constructive comments and suggestions provided me with productive ideas that greatly improved my work. Their various views and feedback had given me valuable sights that contributed to the quality of this dissertation.
It is my utmost pleasure to thank the following individuals: Professor Fred Davis and Dr. Abdulkafi Albirini for granting me the permission to adopt, modify, and translate several items from their instrument. To the four experts who kind-heartedly validated my questionnaire, Professor Dr. Fong Soon Fook, Professor Dr. Baharuddin Aris, Dr. Ahmad Fauzi bin Mohd Ayub, and Dr. Koo Ah Choo. The language experts Madam Norhuda Abdullah, Mr. Md. Khambari Manot, and Mr. Johnson Sundrasehgar Chelliah who willingly helped me with the double back language translation of the instrument. To Associate Professor Dr. Karuthan Chinna who constantly guided me primarily in the statistical analysis of the data using Structural Equation Modeling.

My heartiest and sincere gratitude also goes to my dear parents who have always sought to elicit the best in me. They have been my inspiration and spiritual strength on the journey to achieve this degree. Thanks a million for all the sacrifices that you have made for me. I also owe my deepest gratitude to my magnificent sisters and brother; Gershal, Loveesal, Publius, and Eunice for their overwhelming care, unremitting guidance and endless support till this very day. Not forgetting Thomas, Jeya Mark, and Jasintha for their concern, care and support. This dissertation would have not been possible without the support of my dearly loved family members.
I would also like to thank Mr. & Mrs. Paul, Melvin and Christina for their support, concern, and love throughout my studies in university. Thank you to my aunty in Sitiawan, Mrs. Maher John for her continual prayers and encouragement. I also thank my dear friends, especially Mas Nida, Aida, Nisha, Shalini, Afikah, Liyana, Norliza, Norsidah, Marzni, Hasnah Tang, Liza and many others for all the enjoyable and remarkable memories that we had together for the past years.

I would like to express my sincere appreciation to the Graduate Research Fellowship and Mini Budget for providing me the financial aid to further my studies. I also wish to convey my deepest gratitude to the Educational Planning and Research Division, Ministry of Education; Selangor Education Department; Negeri Sembilan Education Department, Kuala Lumpur Federal Territory Education Department; and Putrajaya Federal Territory Education Office, for granting me the approval to carry out the study. It is a pleasure to thank all the principals and teachers who gave their full support and co-operation throughout the process of my data collection.

Last but not least, I am heartily grateful to express my utmost gratitude and appreciation to each and everyone who has contributed in one way or another by being a part of my thesis. Thank you very much!
This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Doctor of Philosophy. The members of the Supervisory Committee were as follows:

**Wong Su Luan, PhD**  
Associate Professor  
Faculty of Educational Studies  
Universiti Putra Malaysia  
(Member)

**Kamariah Abu Bakar, PhD**  
Professor  
Faculty of Educational Studies  
Universiti Putra Malaysia  
(Member)

**Rosnaini Mahmud, PhD**  
Lecturer  
Faculty of Educational Studies  
Universiti Putra Malaysia  
(Member)

---

**BUJANG BIN KIM HUAT, PhD**  
Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:
DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.

________________________
PRISCILLA MOSES

Date: 27 February 2012
TABLE OF CONTENTS

ABSTRACT iii
ABSTRAK vii
ACKNOWLEDGEMENTS xi
APPROVAL xiv
DECLARATION xvi
LIST OF TABLES xxii
LIST OF FIGURES xxvii
LIST OF ABBREVIATIONS xxxi

CHAPTER

1 INTRODUCTION

1.1 Background 1
1.2 Laptop Initiatives 4
1.3 Benefits and Challenges of Laptop Initiatives 9
1.4 Statement of the Problem 14
1.5 Objectives of the Study 16
1.6 Hypotheses of the Study 17
1.7 Significance of the Study 20
1.8 Scope and Limitations of the Study 24
1.9 Definition of Terms 27
1.9.1 Laptop Use 27
1.9.2 Teaching and Learning 27
1.9.3 Laptop Competence 28
1.9.4 Perceived Ease of Use 29
1.9.5 Perceived Usefulness 29
1.9.6 Attitude towards Laptop Use 30
1.9.7 Administrator’s Support 30
1.9.8 Technical Support 31
1.9.9 Influence 31
1.9.10 Mediator 32
1.9.11 Moderator 32
1.9.12 Subject Matter 32
1.9.13 Secondary School Mathematics and Science teachers 33

2 LITERATURE REVIEW

2.1 Introduction 34
2.2 Theories Related to the Study 35
2.2.1 Theories of Reasoned Action 35
2.2.2 Technology Acceptance Model 38
2.3 Technology Use in Teaching and Learning 45
2.4 Laptop Use among Teachers 48
2.5 Subject Matter as a Moderator for Laptop Use among Teachers Teaching Mathematics and Science Subjects 52
2.6 Predictor Factors Related to Technology Use among Teachers 56
  2.6.1 Laptop Competence 61
  2.6.2 Perceived Ease of Use 67
  2.6.3 Perceived Usefulness 69
  2.6.4 Attitude towards Laptop Use 72
  2.6.5 Administrator’s Support 74
  2.6.6 Technical Support 77
2.7 Theoretical Framework 81
2.8 Conceptual Framework 85

3 METHODOLOGY
  3.1 Introduction 88
  3.2 Research Design 88
  3.3 Location of the Study 92
  3.4 Population 94
  3.5 Sample Size 95
  3.6 Sampling 98
  3.7 Instrumentation 103
    3.7.1 Reverse Scoring 111
    3.7.2 Double Back Language Translation 112
  3.8 Validity and Reliability 113
    3.8.1 Validity 113
    3.8.2 Reliability 116
      3.8.2.1 Pilot Test 117
  3.9 Data Collection and Data Entry 126
  3.10 Data Analysis 129

4 RESULTS AND FINDINGS
  4.1 Introduction 145
  4.2 Preliminary Statistical Analysis 146
  4.3 Demographic Information 153
  4.4 Structural Equation Modeling 158
    4.4.1 The Influence of Predictors on the Model Measuring the Use of Laptop in the Teaching and Learning
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.4.1.1 Defining Individual Constructs</td>
<td>159</td>
</tr>
<tr>
<td>4.4.1.2 Developing the Overall Measurement Model</td>
<td>159</td>
</tr>
<tr>
<td>4.4.1.3 Designing a Study to Produce Empirical Results</td>
<td>165</td>
</tr>
<tr>
<td>4.4.1.4 Assessing Measurement Model Validity</td>
<td>165</td>
</tr>
<tr>
<td>4.4.1.5 Specifying the Structural Model</td>
<td>240</td>
</tr>
<tr>
<td>4.4.1.6 Assessing Structural Model Validity</td>
<td>243</td>
</tr>
<tr>
<td>4.4.2 Mediating Variables</td>
<td>257</td>
</tr>
<tr>
<td>4.4.3 Subject Matter as a Moderator</td>
<td>271</td>
</tr>
</tbody>
</table>

5 SUMMARY, DISCUSSION, CONCLUSION, IMPLICATIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1 Introduction</td>
<td>281</td>
</tr>
<tr>
<td>5.2 Summary of the Study</td>
<td>281</td>
</tr>
<tr>
<td>5.3 Discussion</td>
<td>285</td>
</tr>
<tr>
<td>5.3.1 The Influence of Predictors on the Model Measuring the Use of Laptop in the Teaching and Learning</td>
<td>286</td>
</tr>
<tr>
<td>5.3.2 Mediating Variables</td>
<td>292</td>
</tr>
<tr>
<td>5.3.3 Subject Matter as a Moderator</td>
<td>296</td>
</tr>
<tr>
<td>5.4 Conclusion</td>
<td>299</td>
</tr>
<tr>
<td>5.5 Implications</td>
<td>300</td>
</tr>
<tr>
<td>5.5.1 Theoretical Implications</td>
<td>301</td>
</tr>
<tr>
<td>5.5.2 Practical Implications</td>
<td>303</td>
</tr>
<tr>
<td>5.6 Recommendations for Future Research</td>
<td>308</td>
</tr>
</tbody>
</table>

REFERENCES                                                                 | 312  |
APPENDICES

A  Original Data  329
A1  Nine Challenges of Vision 2020  330
A2  North Carolina Educational Technology Competency  332

B  Sample  337
B1  List of Schools Randomly Selected in this Study  338

C  Research Instrument  340
C1  Questionnaire  341

D  Letters of Authority  356
D1  Author’s Permission to Modify and Translate the Instrument  357
D2  Written Permission from the Educational Planning and Research Division, Ministry of Education  359
D3  Written Permission from the Educational Departments in the Central Region  361

E  Credentials  366
E1  Credentials for Language Experts  367
E2  Credentials for Panel of Experts  369
E3  Credentials for Statistician (SEM expert)  371

F  Data  372
F1  Extreme Outliers  373
F2  Normality Test  374
F3  Linearity Test  381
F4  Inter-item Correlation for Items to Measure Laptop Competence  382

BIODATA OF STUDENT  383
LIST OF PUBLICATIONS  384