05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

EXAMINING ATTENTION CUES FOR LEARNING 3D MODELLING SOFTWARE: AN EYE-TRACKING STUDY ON INSTRUCTIONAL SCREENCAST

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

SHARMILA DEVI A/P PACHIYAPPAN

UNIVERSITI PENDIDIKAN SULTAN IDRIS

2017

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

EXAMINING ATTENTION CUES FOR LEARNING 3D MODELLING SOFTWARE: AN EYE-TRACKING STUDY ON INSTRUCTIONAL SCREENCAST

SHARMILA DEVI A/P PACHIYAPPAN

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

TESIS DIKEMUKAKAN BAGI MEMENUHI SYARAT UNTUK MEMPEROLEH IJAZAH SARJANA REKA BENTUK (INSTRUKSI MEDIA) (MOD PENYELIDIKAN)

FAKULTI SENI, KOMPUTERAN DAN INDUSTRI KREATIF
UNIVERSITI PENDIDIKAN SULTAN IDRIS

2017

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

UNIVERSITI PENDIDIKAN SULTAN IDRIS
SULTAN IDRIS EDUCATION UNIVERSITY

Please tick (√)
Project Paper
Masters by Research
Master by Mixed Mode
PhD

INSTITUTE OF GRADUATE STUDIES

DECLARATION OF ORIGINAL WORK

This declaration is made on the 7th day of January 2020.

i. Student's Declaration:

I, Sharmila Devi a/p Pachiyappan, M20132002442, FSKIK (PLEASE INDICATE STUDENT'S NAME, MATRIC NO. AND FACULTY) hereby declare that the work entitled Examining Attention Cues For Learning 3D Modelling Software : An Eye-Tracking Study On Instructional Screencast is my original work. I have not copied from any other students' work or from any other sources except where due reference or acknowledgement is made explicitly in the text, nor has any part been written for me by another person.

Sharmila.

Signature of the student

ii. Supervisor's Declaration:

I Tan Wee Hoe (SUPERVISOR'S NAME) hereby certifies that the work entitled Examining Attention Cues for Learning 3D Modelling Software : An eye-tracking study on instructional screencast (TITLE) was prepared by the above named student, and was submitted to the Institute of Graduate Studies as a * partial/full fulfillment for the conferment of Master of Design (Instructional Media) (PLEASE INDICATE THE DEGREE), and the aforementioned work, to the best of my knowledge, is the said student's work.

7/1/2020

Date

Signature of the Supervisor

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

UNIVERSITI PENDIDIKAN SULTAN IDRIS
SULTAN IDRIS EDUCATION UNIVERSITY

INSTITUT PENGAJIAN SISWAZAH /
INSTITUTE OF GRADUATE STUDIES

BORANG PENGESAHAN PENYERAHAN TESIS/DISERTASI/LAPORAN KERTAS PROJEK
DECLARATION OF THESIS/DISSERTATION/PROJECT PAPER FORM

Tajuk / *Title*: Examining Attention Cues For Learning 3D Modelling Software : An Eye-Tracking Study On Instructional Screencast

No. Matrik /*Matric's No.*: M20132002442

Saya / *I* : Sharmla Devi A/P Pachiyapan

(Nama pelajar / *Student's Name*)

mengaku membenarkan Tesis/Disertasi/Laporan Kertas Projek (Doktor Falsafah/Sarjana)* ini disimpan di Universiti Pendidikan Sultan Idris (Perpustakaan Tuanku Bainun) dengan syarat-syarat kegunaan seperti berikut:-
acknowledged that Universiti Pendidikan Sultan Idris (Tuanku Bainun Library) reserves the right as follows:-

1. Tesis/Disertasi/Laporan Kertas Projek ini adalah hak milik UPSI.
   The thesis is the property of Universiti Pendidikan Sultan Idris
2. Perpustakaan Tuanku Bainun dibenarkan membuat salinan untuk tujuan rujukan sahaja.
   Tuanku Bainun Library has the right to make copies for the purpose of research only.
3. Perpustakaan dibenarkan membuat salinan Tesis/Disertasi ini sebagai bahan pertukaran antara Institusi Pengajian Tinggi.
   The Library has the right to make copies of the thesis for academic exchange.
4. Perpustakaan tidak dibenarkan membuat penjualan salinan Tesis/Disertasi ini bagi kategori **TIDAK TERHAD**.
   The Library are not allowed to make any profit for 'Open Access' Thesis/Dissertation.
5. Sila tandakan (√) bagi pilihan kategori di bawah */ Please tick (√) for category below:-*

☐ **SULIT/*CONFIDENTIAL*** — Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub dalam Akta Rahsia Rasmi 1972. / *Contains confidential information under the Official Secret Act 1972*

☐ **TERHAD/*RESTRICTED*** — Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan ini dijalankan. / *Contains restircted information as specified by the organization where research was done.*

☒ **TIDAK TERHAD / *OPEN ACCESS***

Sharmla

(Tandatangan Pelajar/ Signature)

Tarikh: 7/1/2020

(Tandatangan Penyelia / *Signature of Supervisor*)
& (Nama & Cop Rasmi / *Name & Official Stamp*)

PROF. MADYA DR. TAN WEE HOE
Jabatan Multimedia Kreatif
Fakulti Seni, Komputeran dan Industri Kreatif
Universiti Pendidikan Sultan Idris
35900 Tanjong Malim, Perak

Catatan: Jika Tesis/Disertasi ini **SULIT @ TERHAD**, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali sebab dan tempoh laporan ini perlu dikelaskan sebagai **SULIT** dan **TERHAD**.

Notes: If the thesis is CONFIDENTAL or RESTRICTED, please attach with the letter from the organization with period and reasons for confidentiality or restriction.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

ACKNOWLEDGEMENT

First and foremost, my gratitude goes to God almighty for granting me the strength and courage to endure challenging two and half years of my master's study. I would like to take this wonderful opportunity to thank all those people who have helped me throughout this period. My highest gratitude goes to my supervisor, Associate Professor Dr. Tan Wee Hoe for all his systematic guidance and offering me lots of valuable advice during the whole period of my research study. I would also like to extend my gratitude to my co-supervisor, Associate Professor Dr. Ahmad Zamzuri Bin Mohamad Ali for the motivation and guidance in the completion of my research study. Furthermore, my heartfelt appreciation goes to my parents, Mr. and Mrs. Pachiyappan for their support and encouragement throughout this study. Thank you for being my inspiration for the success of my life. Moreover, I warmly thank my sisters who support and encourage me when most needed. Last but not least, I would like to thank the entire Bachelor of Animation students who participated in this research for their support and effort. In a nutshell, I feel blessed to have completed my master's study successfully. I would like to thank again all the people that have helped me throughout this study period.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi
05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

ABSTRACT

This study was aimed to develop and validate an instructional framework that can be used to produce effective and efficient screencast video for learning 3D modelling software. Four variations of instructional screencast video were designed and developed specifically for this study. At the beginning of this study, a series of semi-structured interviews were conducted with six undergraduate students of Sultan Idris Education University who took the MMG3083 Modelling course. These students believed that they learned better by watching instructional screencast video as opposed to static media. Most of them agreed that screencast video can help them in learning 3D modelling. Subsequently, two single-group post-test only quasi-experiments were carried out using Tobii Eye Tracker to examine the effectiveness and efficiency of different variations of instructional screencast videos. In the first quasi-experiment, screencast without caption was found statistically more efficient for research participants to learn 3D modelling software as compared to screencast with caption. The second study indicated that unedited screencast the most effective screencast video for learning 3D modelling. These findings were revealed based on the analysis of interest areas generated by individual participants when interacting with four variations of screencast videos. However, the findings of a series of follow-up semi-structured interview revealed that most participants believed screencast videos with caption and subtitle were suitable for learning 3D modelling software. In conclusion, all variations of screencast videos were effective for learning 3D modelling software. However, only unedited screencast video was the most efficient compared to screencast video with caption, screencast video with subtitle and screencast video with caption and subtitle. The key contribution of this study is the success of developing a set of guiding principles for instructional designers to prepare screencast video.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

MENGKAJI ISYARAT PEMERHATIAN UNTUK PEMBELAJARAN PERISIAN PEMODELAN 3D: SATU KAJIAN PENJEJAKAN MATA PADA INSTRUKSI RAKAMAN SKRIN

ABSTRAK

Kajian ini bertujuan untuk membangunkan dan mengesahkan kerangka instruksi yang boleh digunakan untuk menghasilkan rakaman skrin video yang cekap dan berkesan untuk pembelajaran perisian pemodelan 3D. Empat variasi instruksi rakaman skrin video telah direka dan dibangunkan khusus untuk kajian ini. Pada awal kajian, satu siri temu bual separa berstruktur telah dijalankan bersama enam orang pelajar ijazah sarjana muda dari Universiti Pendidikan Sultan Idris yang mengambil kursus MMG3083 Pemodelan. Semua pelajar tersebut percaya bahawa mereka dapat belajar dengan lebih baik dengan menonton instruksi rakaman skrin video berbanding dengan pendedahan kepada media statik. Kebanyakan pelajar bersetuju bahawa rakaman skrin video boleh membantu mereka dalam pembelajaran pemodelan 3D. Selepas itu, dua ujian pasca eksperimen kuasi satu kumpulan telah dijalankan dengan menggunakan *Tobii Eye Tracker* untuk mengkaji keberkesanan dan kecekapan instruksi rakaman skrin video yang berbeza variasi. Dalam eksperimen kuasi yang pertama, rakaman skrin video tanpa kapsyen didapati lebih cekap secara statistik bagi peserta kajian untuk mempelajari perisian pemodelan 3D berbanding rakam skrin video dengan kapsyen. Kajian kedua menunjukkan bahawa rakaman skrin video tanpa disunting merupakan rakaman skrin video yang paling berkesan untuk mempelajari pemodelan 3D. Hasil dapatan ini telah didedahkan berdasarkan analisis kawasan berkepentingan yang dijana oleh peserta kajian semasa berinteraksi dengan empat variasi rakaman skrin video. Walau bagaimanapun, hasil temubual susulan separa berstruktur menunjukkan kebanyakan peserta percaya bahawa rakaman skrin video dengan kapsyen dan sari kata sesuai bagi pembelajaran perisian pemodelan 3D. Kesimpulannya, semua variasi rakaman skrin video adalah berkesan untuk pembelajaran perisian pemodelan 3D. Namun demikian, rakaman skrin video tanpa disunting adalah paling cekap berbanding dengan rakaman skrin video dengan kapsyen, rakaman skrin video dengan sari kata dan rakaman skrin video dengan kapsyen dan sari kata. Sumbangan utama kajian ini adalah kejayaan dalam membangunkan satu set prinsip panduan untuk pereka instruksi dalam penyediaan rakaman skrin video.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

TABLE OF CONTENT

		Page
RECOGNITION		**ii**
ACKNOWLEDGEMENT		**iii**
ABSTRACT		**iv**
ABSTRAK		**v**
TABLE OF CONTENT		**vi**
LIST OF TABLE		**xii**
LIST OF FIGURE		**xiv**
LIST OF ABBREVIATION		**xvi**
APPENDIX LIST		**xvii**
CHAPTER 1	**INTRODUCTION**	
	1.1 Overview	1
	1.2 Background of the Research	2
	1.3 Research Problem and Hypothetical Propositions	2
	1.4 Research Objectives	6
	1.5 Research Question	7
	1.6 Methodology	7
	1.7 Operational Definition of Key Concepts	8
	1.7.1 Learning	8
	1.7.2 Attention Cue	9

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1.7.3 3D Modelling 10

1.7.4 3D Modelling Software 11

1.7.5 Eye-tracking 11

1.7.6 Screencast 12

1.7.7 Instructional Screencast Video 13

1.8 Delimitations of Scope and Key Assumptions 15

1.8.1 Scope 15

1.8.2 Limitation 16

CHAPTER 2 LITERATURE REVIEW

2.1 Introduction 18

2.2 Scope of Research 19

2.3 Instructional Screencast Video 20

2.3.1 Learning through Video 20

2.3.2 Learning through Instructional Screencast Video 25

2.3.3 Strength and Weaknesses of Learning through Screencast Video 33

2.3.4 Learning through 3D Modelling Software 34

2.3.5 Types of 3D Modelling Software 35

2.4 Eye-tracking Study 36

2.4.1 Eye Tracker Visualisation 45

2.5 Attention Cues Study 49

2.5.1 Attention Cues on Instructional Screencast Video 53

2.6 Conclusion 54

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

CHAPTER 3 SCREENCAST VIDEO DEVELOPMENT

3.1 Introduction 55

3.2 Selection of Screencasting Software 56

3.3 Screencasting Framework 58

3.4 Screencast Video Creation Process 59

3.5 Screencast Video Development 62

3.5.1 Explorative Preliminary Study 62

3.5.2 Comparative Study 68

3.6 Conclusion 72

CHAPTER 4 METHODOLOGY

4.1 Introduction 73

4.2 Exploratory Studies 76

4.2.1 Semi-Structured Interview 76

4.2.2 Explorative Preliminary Study 78

4.3 Comparative Study 82

4.3.1 Single-Group Post-test-only Quasi-experiment 82

4.3.2 Selection of Research Participants 84

4.3.3 Procedure of Data Collection 89

4.3.4 Workflow of Eye-tracking Process 94

4.3.5 Data Analysis Process 98

4.4 Follow-Up In-Depth Semi-Structured Interviews 98

4.4.1 Coding for Themes and Narratives 99

4.4.2 Ethical Considerations 100

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

4.5 Conclusion 100

CHAPTER 5 FINDINGS

5.1 Introduction 102

5.2 Explorative Semi Structured Interview 103

5.2.1 Perception on Using of Game-based Learning Website to Learn 3ds Max 105

5.2.2 Perception on Using Screencast in Learning 3D Modelling Software 106

5.2.3 Experience of Creating Screencast to Instruct 3D Modelling 108

5.3 Explorative Preliminary Study 109

5.3.1 Prior Knowledge Test 111

5.3.2 Single-group Post-test-only Quasi-experiment 112

5.3.3 Difference in Terms of Time Spent between Seven Variations of Screencast Videos 115

5.3.4 Differences in Terms of Time Spent between Screencast with Caption and Screencast without Caption 118

5.3.5 Differences in Terms of Time Spent between Screencast with Narration and Screencast without Narration 119

5.3.6 Differences in Terms of Time Spent between Screencast with Subtitle and Screencast without Subtitle 119

5.4 Findings of Comparative Study 120

5.4.1 Differences in Terms of Time Spent between Four Different Variations of Screencast Videos 124

5.4.2 Differences in Terms of Time Spent between Unedited Screencast and Screencast with Caption 126

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

5.4.3 Differences in Terms of Time Spent between Unedited Screencast and Screencast with Subtitle 128

5.4.4 Differences in Terms of Time Spent between Unedited Screencast and Screencast with Caption and Subtitle 130

5.4.5 Differences in Terms of Time Spent between Screencast with Caption and Screencast with Caption and Subtitle 132

5.4.6 Differences in Terms of Time Spent between Screencast with Caption and Screencast with Subtitle 134

5.4.7 Differences in Terms of Time Spent between Screencast with Subtitle and Screencast with Caption and Subtitle 136

5.4.8 Differences in Terms of Fixation Duration between of Four Different Variations of Screencast Videos 138

5.4.9 Differences in Terms of Fixation Duration between Screencast with Caption and Screencast With Subtitle 141

5.4.10 Differences in Terms of Fixation Duration between Screencast with Caption and Screencast with Caption and Subtitle 143

5.4.11 Differences in Terms of Fixation Duration Between Screencast with Subtitle and Screencast with Caption and Subtitle 145

5.4.12 Differences in Terms of Fixation Duration Between Unedited Screencast and Screencast with Caption 147

5.4.13 Differences in Terms of Fixation Duration Between Unedited Screencast and Screencast with Subtitle 149

5.4.14 Differences in Terms of Fixation Duration Between Unedited Screencast and Screencast with Caption and Subtitle 151

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

5.5 Follow-Up Semi Structured Interview in Explanatory Study 153

5.5.1 Perception on the Use of Screencast Video to Learn 3ds Max 155

5.5.2 Preferences on the Type of Screencast Video Variations for Learning 3D Modelling 156

5.5.3 Perceptions on the Result Obtain from the Comparative Study 156

5.6 Conclusion 158

CHAPTER 6 CONCLUSION

6.1 Introduction 159

6.2 Hypothetical Proposition 160

6.3 Guiding Principles to Develop An Instructional Framework for Multimedia Designers 165

6.4 The Contribution of the Research 171

6.5 Challenges in Eye-Tracking Research 171

6.6 Limitation of the Research 173

6.7 Recommendations for Future Study 174

REFERENCES

APPENDIX

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

LIST OF TABLE

No.	Table	Page
2.1	Strength and Weaknesses of Learning through Screencast	34
2.2	List of Several 3D Modelling Software	36
2.3	Types of Visualisation	46
3.1	Comparison of Three Screencasting Software	57
3.2	Elements of Instructional Screencast Video	59
4.1	The Stages in Data Collection Process	75
4.2	Interview Questions Set for the Exploratory Study	78
4.3	Variations of Screencast Video	81
4.4	Single-group Post-test-only Quasi-experiment for Comparative Study	83
4.5	Observations of Eye Motion of the Beginner Participants When Watching Screencast Video	84
4.6	Parts in Tobii X2-30 Eye Tracker Package	86
4.7	Follow-up Semi-Structured Interviews Question	99
5.1	Demographic Profile of Interviewees in the Semi-Structured Interview	103
5.2	Interview Questions Set for the Exploratory Study	105
5.3	Demographic Profile of Participants in the Explorative Preliminary Study	110
5.4	Variations of Screencast Video	113
5.5	Time Spent by Each Group of Participants to Complete the Given Task	117
5.6	Demographic Profile of Participants in the Comparative Study	121
5.7	Calibration of Participants' Eye Movement in Comparative Study	123

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

5.8	Time Spent by Each Group of Participants to Complete the Given Task	125
5.9	Time Spent by Participants to Complete the Given Task Using Unedited Screencast and Screencast with Caption	127
5.10	Time Spent by Participants to Complete the Given Task Using Screencast with Unedited Screencast and Screencast with Subtitle	129
5.11	Time Spent by Participants to Complete the Given Task Using Unedited Screencast and Screencast with Caption and Subtitle	131
5.12	Time Spent by Participants to Complete the Given Task Using Screencast with Caption and Screencast with Caption and Subtitle	133
5.13	Time Spent by Participants to Complete the Given Task Using Screencast with Caption and Screencast with Subtitle	135
5.14	Time Spent by Participants to Complete the Given Task Using Screencast with Subtitle and Screencast with Caption and Subtitle	137
5.15	Fixation Duration of Participants When Watching Screencast Videos (Four Types)	140
5.16	Fixation Duration of Participants When Watching Screencast with Caption and Screencast with Subtitle	142
5.17	Fixation Duration of Participants When Watching Screencast with Caption and Screencast with Caption and Subtitle	144
5.18	Fixation Duration of Participants When Watching Screencast with Subtitle and Screencast with Caption and Subtitle	146
5.19	Fixation Duration of Participants When Watching Unedited Screencast and Screencast with Caption	148
5.20	Fixation Duration of Participants When Watching Unedited Screencast and Screencast with Subtitle	150
5.21	Fixation Duration of Participants When Watching Unedited Screencast and Screencast with Caption and Subtitle	152
5.22	Demographic Profile of Interviewees in the Follow-Up Semi-Structured Interview	154
5.23	Follow-up Semi-Structured Interviews Question	155

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

LIST OF FIGURE

No.	Figure	Page
2.1	Scope of Research	19
2.2	Human Memory Structure involved in Explorative Preliminary Study	30
2.3	Human Memory Structure involved in Comparative Study	30
2.4	Anatomy of the Human Eye	38
2.5	Scene Perception	40
2.6	Human Position When Using Eye Tracking Devices	41
2.7	Gaze Plot	47
2.8	Heat Map	48
2.9	Cluster	48
2.10	Area of interest	49
2.11	Eye Movements	50
3.1	Procedure of Creating Instructional Screencast Video	60
3.2	Screencast Video Development Flow Chart for Explorative Preliminary Study	64
3.3	Screencast Video with Caption	65
3.4	Screencast Video with Narration	65
3.5	Screencast Video with Subtitle	66
3.6	Screencast Video with Caption and Subtitle	66
3.7	Screencast Video with Narration and Caption	67
3.8	Screencast with Narration and Subtitle	67
3.9	Screencast with Narration, Captions and Subtitle	68
3.10	Screencast Video Development Flow Chart for Comparative Study	69

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

3.11	Unedited Screencast Video	70
3.12	Screencast Video with Caption	70
3.13	Screencast Video with Subtitle	71
3.14	Screencast Video with Caption and Subtitle	71
4.1	The Mixed Method Design Proposed for this Research	74
4.2	Prior Knowledge Test, Learning Process and Single-group Post-test-only Quasi-experiment	80
4.3	Eye-Tracking Process	90
4.4	Calibration Points	91
4.5	Visualisation for Unedited Sceencast	92
4.6	Visualisation for Screencast with Caption	92
4.7	Visualisation for Screencast with Subtitle	93
4.8	Visualisation for Screencast with Caption and Subtitle	93
4.9	Workflow of Eye-Tracking Process	94
4.10	Test Design	95
4.11	Replay	96
4.12	Visualisation	97
4.13	Statistic	97
5.1	PMRPG Site	104

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

LIST OF ABBREVIATIONS

RAGS	Research Acculturation Grant Scheme
AOIs	Area of Interest
SOA	Stimulus-onset Asynchronies
IOR	Inhibition of Return
FLV	Flash Video
MP4	Motion Picture Expert Group 4
AVI	Audio Video Interleave
UPSI	Utopian Pedagogic School of Innovation
PMRPG	Physical Multiplayer Role Playing Game
IBM SPSS	International Business Machines Corporation Statistical Package for the Social Sciences

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi
05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

APPENDIX LIST

A	Screenshot of Seven Types of Screencast Video in Explorative Preliminary Study
B	Screenshot of Four Types of Screencast Video in Comparative Study
C	Video Script for Seven Variations of Screencast Video in Explorative Preliminary Study
D	Video Script for Four Variations of screencast videos in Comparative Study
E	Information Sheet for Explorative Preliminary Study
F	Consent Form for Explorative Preliminary Study
G	Prior Knowledge Test and Post-test Task in Explorative Preliminary Study
H	Information Sheet for Comparative Study
I	Consent Form for Comparative Study
J	Questionnaire Form for Follow-up Semi-structured Interview
K	Transcription and Themes for Explorative Preliminary Study (Semi-Structured Interview) and Explanatory Study (Follow-Up Semi-Structured Interview)

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

CHAPTER 1

INTRODUCTION

1.1 Overview

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

This research focuses on generating a set of guiding principles for learning 3D modelling software through instructional screencast video. The proposed guiding principles would be a result of an eye-tracking study on the above mentioned instructional screencast video. In particular, the study examined the attention cues of participants when watching the visual contents of instructional screencast video. Based on the provisional guiding principles, the research aims to develop and validate an instructional framework for multimedia designers to produce efficient screencast video for learning 3D modelling software. This dissertation is prepared to outline the structure of the research, present the literature review, research methodology, findings and conclusion of this Master's study.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1.2 Background of the Research

This research is partially funded by Malaysian Ministry of Higher Education through Research Acculturation Grant Scheme (RAGS). The RAGS project titled "Examining modality principles of instructional screencast video for learning 3D modelling software", was a two-year empirical study, which was completed in January 2016. As a subset of the RAGS project, this research focuses on issues related to attention cues, while the RAGS project covered a more generic scope of modality principles used for learning 3D modelling software.

1.3 Research Problem and Hypothetical Propositions

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

Video is a great tool used in education to contribute the learning outcome of video-based learning (Yousef, Chatti & Schroeder, 2014). YouTube is one of the popular platforms that contain video-sharing recourses as additional material to enhance learning ability of learner (Sherer & Shea, 2011). Likewise, screencast video is promptly becoming a popular resource of learning by which learners are able to learn by observing demonstrations on screen (Martin & Martin, 2015). Gormley and McDermott (2011) stated that an educator or developer needs to select the right screencasting software before starting to create a screencast video. Screencasting software was used as video capturing tool by recording the activities that was held on a computer screen (Oud, 2011).

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

With the advancement of video capturing and video sharing platforms, the use of instructional screencast video for teaching and learning computer software and applications has become a norm among university and college lecturers (Brown-Sica, Sobel & Pan, 2009). As to diversify ways of teaching and learning, teachers were tend to use video as a reference learning material for presenting the learning content to students (Helft, 2009).

Even though technological advancement has afforded lecturers to capture screens, there is a lack of guiding principles in designing and developing instructional screencast videos, particularly for teaching and learning software that requires complex steps and procedures, such as 3D modelling software. The use of multimedia elements in development of video has shaped the presentation approaches of video contents. Generally, video contents can be included with audio elements like narration and text elements like subtitle and caption (Smaldino, Lowther & Russell, 2008). Therefore, Mayer (2001) proposed a multimedia presentation that combines visual and verbal information as an effective learning approach which may cause both memory channels i.e. short-term memory and long-term memory to be used.

In contrast, the study conducted by Veronikas and Maushak (2005) revealed that there were no significant differences between students who use screencast with both text and narration, screencast that only containing text or (and) screencast that only containing narration. A study conducted by Ahmad, Khairulanuar, Mohamad and Salman (2011) revealed that screencast video with narration is effective and efficient

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

to enhance students' learning attainment. In addition, a study conducted by Tisdell and Loch (2017) have indicated that most of the students agreed that the captions are useful for the purpose of learning in order to clarify the explanations that are difficult to hear in a recording.

The inconsistency of findings may occur due to the failure of developers in paying attention against cognitive overloading issues. When too much information are displayed, elements of narration and text appear concurrently while image appears too fast (Bell & Bull, 2010; Mayer, 2002). Therefore this research was carried out to resolve the above-mentioned issue by examining the feasibility of four types of instructional screencast video for learning 3D modelling software.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

Two exploratory studies were carried out to understand issues associated with the use of instructional screencast videos in learning 3D modelling software (refer section 4.1). The findings of the studies were meant to generate hypothetical propositions, which were tested in an eye-tracking study. Four types of instructional screencast video were developed for the eye-tracking study.

Herewith the six hypothetical propositions which were tested in the eye-tracking study:

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1. When learning 3D modelling software through screencast video, there is no significant difference in terms of attention cues between unedited screencast video and screencast video with caption.

2. When learning 3D modelling software through screencast video, there is no significant difference in terms of attention cues between unedited screencast video and screencast video with subtitle.

3. When learning 3D modelling software through screencast video, there is no significant difference in terms of attention cues between unedited screencast video and screencast video with caption and subtitle.

4. When learning 3D modelling software through screencast video, there is no significant difference in terms of attention cues between screencast video with caption and screencast video with subtitle.

5. When learning 3D modelling software through screencast video, there is no significant difference in terms of attention cues between screencast video with caption and screencast video with caption and subtitle.

6. When learning 3D modelling software through screencast video, there is no significant difference in terms of attention cues between screencast video with subtitle and screencast video with caption and subtitle.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1.4 Research Objectives

The aim of this research is to compare participants' attention cues on four different types of instructional screencast video when learning 3D modelling software. To achieve this aim, the following research objectives were set in this study:

- To design and develop instructional screencast videos for learning 3D modelling.
- To compare the efficiency of seven types of screencast video.
- To investigate the attention cues of participants when watching four types of screencast video.
- To examine the reasons behind the attention cue findings.

The outcomes of this research were used to prepare a set of guiding principles for teachers, lecturers or software instructors to design instructional screencast video for efficient learning of 3D modelling software.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1.5 Research Question

The key research question for this study was "what are the differences between four variations of instructional screencast video in term of participants' attention cues when learning 3D modelling software?"

1.6 Methodology

This research is divided into three phases—exploratory, comparative and explanatory phases, involving mixed methods in data collection and analysis. It began in the year 2014 with a semi-structured interview to explore participants' perception on the use of website and screencast video as instructional media, and then followed by an explorative preliminary study to gauge an initial understanding and the feasibility upon the use of instructional screencast video in a modelling course. The findings of these two exploratory studies were used to construct six hypothetical propositions, which were tested in a comparative study.

The comparative study was carried out through a single-group post-test-only quasi-experiment, in which a post-test were administered on participants' attention cues when learning 3D modelling software through instructional screencast videos. Tobii eye-tracking system was used, in which the oculomotor fixation and saccadic behaviours were recorded and analysed using Tobii Studio and IBM SPSS Statistics

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

(International Business Machines Corporation Statistical Package for the Social Sciences).

The findings drawn from the comparative study were followed-up with an explanatory study, where specific participants of the comparative study were interviewed to examine the reasons behind the attention cue findings.

1.7 Operational Definitions of Key Concepts

1.7.1 Learning

Learning is "the acquisition of knowledge or skills through study, experience, or being taught" (learning, 2015). In the contexts of psychology, learning means "the alteration of behaviour as a result of individual experience" (learning, 2015), especially when a human can perceive and change its behaviour. In terms of origin, the concept of learning was formed from Old English "leornung". The root words for learning are "learn" and "-ing".

The word "learn" means "gain or acquire knowledge of or skill in (something) by study, experience, or being taught" (learn, 2015). From a human biological perspective, the concept of modality is connected to sense perception. The word "-

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

ing" can be defined as a "denoting material used for or associated with a process" in which to denote something that involved an action or a process (learning, 2015).

1.7.2 Attention Cue

The word attention is referred to "notice taken by someone or something; the regarding of someone or something as interesting or important" (attention, 2015). Other than that, attention also can be defined as "the action of dealing with or taking special care of someone or something" (attention, 2015). In terms of psychology, attention has been defined as "the concentration of awareness on some phenomenon to the exclusive of other stimuli" (attention, 2015).

On military perspective, attention is a position presumed by soldiers who needs to stand very straight with arms straight down the sides and the feet together of the body. In terms of origin, the concept of attention was formed in the 19th century from Latin from the word "attendere" and "attentio" (attention, 2015).

While the word cue stands for "A thing said or done that serves as a signal to an actor or other performers to enter or to begin their speech or performance" (cue, 2015) which can be described as a signal for action, a piece of information or circumstance which aids the memory in retrieving details not recalled spontaneously and an indication or hint about how to behave in particular circumstances.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

The concept of cue was formed in the 19th century and its origin is unknowable. In psychology perspective, it means a feature of something perceived that is used in the brain's interpretation of the perception. The combination of the word "attention" and "cue" means focus of a visual attention to an area by using a cue.

1.7.3 3D Modelling

The term "3D" refers to "the quality of being three-dimensional" (3D, 2015) which appearing to have or having depth, length and breadth. In the context of literary or dramatic work, 3D means is "sufficiently full in characterization and representation of events to be believable" (three-dimensional, 2015).

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

Modelling in the context of computing means "the activity of making three-dimensional models" (modelling, 2015) e.g. clay modelling and life drawing. In learning perspective, modelling can be defined as "the devising or use of abstract or mathematical models" (modelling, 2015) e.g. policy analysis and macroeconomic modelling. The term "modelling" can also be defined as "shape" which to form or plan after a pattern.

The combination of these two concepts means a process to develop a mathematical representation of a three-dimensional surface of an object using specialized software.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1.7.4 3D Modelling Software

Software is a "programs and other operating information used by a computer" (software, 2015) i.e., the physical components of a computer system. Software also refers to "something used or associated with and usually contrast with hardware" (software, 2015) e.g. a set of program, procedures and related documentation concomitant with system, especially a computer system.

In the context of computing, software is an instruction that directs a computer what to do next and there are two types of software which are application software and system software (software, 2015). System software controls a computer's internal functioning and application software directs the computer to execute commands given by the user.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

The combination of the three words "3D modelling software" means a class of 3D modelling or 3D computer graphic software used to produce 3D models. Individual programs of this class are called applications of modelling.

1.7.5 Eye-Tracking

The word eye is referred to "each of a pair of globular organs of sight in the head of humans and vertebrate animals" (eye-tracking, 2015) which used to track the direction of someone's gaze and someone's power of vision. Eye has been defined as "a

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

specialized light-sensitive sensory structure of animals that in nearly all vertebrates, most arthropods, and some molluscs is the image-forming organ of sight" (eye, 2015). The origin of the word eye is from Germanic in which related to Dutch "oog" and German "Auge".

Tracking is known as "the maintenance of a constant difference in frequency between two or more connected circuits or components" (tracking, 2015). The root words of tracking are "track" and "-ing". Track is defined as "detectable evidence" (track, 2015).

The combination of the word eye-tracking means "a technology that monitors eye movements as a means of detecting abnormalities or of studying how people interact with text or online documents" (eye-tracking, 2015).

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1.7.6 Screencast

In general, screencast is a recording of the visual data on a computer screen with audio narration (Brown, 2007). Ruffini (2012) defined screencast as "a digital video and audio recording of what occurs on a presenter's computer screen, which can be used to create sophisticated, information-rich multimedia presentations". According to Udell (2005), screencast has been defined as "digitally recorded playback of computer screen output which often contains audio narration" which to visually demonstrate information to students.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

Screencast is also defined as digital recordings which record all of the necessary mouse clicks done by the instructor on a computer screen, and always known as “streaming desktop video captures” and “screen captures” (Betty, 2008). The captured video paired with audio to create which clearly explained the action, thoughts, and supporting details of the instructor by using multimedia presentation (Peterson, 2007). Commonly, screencast is always used to teach learners about a topic by demonstrating specific actions related to the particular content area.

1.7.7 Instructional Screencast Video

Instruction is referred to “a direction or order” (instruction, 2015). In the contexts of computing, instruction means “a code in a program which defines and carries out an operation” (instruction, 2015). Instruction also can be defined as “detailed information about how something should be done or operated” (instruction, 2015). In terms of origin, the concept of instruction was formed in the early third century from Late Latin “instructio” and “instruere” (instruction, 2015).

The root word of instruction is “instruct” (instruction, 2015) which means “tell or order someone to do something” (instruction, 2015), especially teach someone a subject or skills in an official and formal way. Instruction also can be defined as e.g.

1. A direction calling for compliance i.e. “precept” (instruction, 2015).

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

2. An outline or manual of technical procedure i.e. “order” (instruction, 2015).

3. A code that tells a computer to perform a particular operation i.e. “directions” (instruction, 2015).

Instructional screencast video is a screencast video which comprises of instruction through information given in simple steps with each of that requiring a correct response by the learner before going on to the next step. In educational contexts, screencast video is the substance which could be used to deliver learning content. Screencast application can be used in many fields e.g.

1. Teaching

   Lesson on a particular topic by showing the step-by-step process by a demonstrator, in which students able to learn the material at their own pace or catch up on missed sessions.

2. Training

   For example orientations to new products and learning new software.

3. YouTube and Blogging

   Communicate facts, ideas, opinions, and so on.

4. Selling

   To sell a product.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

Generally, instructional screencast video is more suitable to be used by the educators for the purpose of learning of the students. Students need to follow the instruction given by the instructor in the screencast video to enhance the learning performance. The instructional screencast video has been developed for the purpose to teach a variety of topics like mathematical modelling (Ellington & Hardin, 2008), object-oriented programming (Lee, Pradhan & Dalgamo, 2008), Dewey Decimal Classification System (Peterson, 2007), nursing (Phillips & Billings, 2007) and so on.

1.8 Delimitations of Scope and Key Assumptions

1.8.1 Scope

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

1. Users

The users of the developed screencast video were divided into three groups. The first group of users is the respondents in the stage of formative evaluation. These respondents provided some comments by viewing the developed screencast video. The second group is the users who can access the OpenLearning Universiti Pendidikan Sultan Idris site to view the developed screencast videos. The third group is the studying participants who learned the seven variations of screencast videos in an explorative preliminary study and four types of screencast videos in the comparative study.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

The users in the comparative study were then involved in the explanatory study in which they were required to give their opinions and suggestions based on their experience when using screencast videos in learning 3D modelling and creating an animation for "A" model using 3ds Max software.

2. Application

In the explorative preliminary study, seven variations of screencast videos which contain basic modules on creating a hedra polygon model in 3ds Max software and set-up of three-point lighting for the hedra polygon model were developed. While in the comparative study, four variations of screencast videos that explained on the creation of "A" model using 3ds Max software were developed.

1.8.2 Limitation

There are several limitations involved in this study:

1. This study developed four types of screencast video which are unedited screencast video, screencast video with caption, screencast video with subtitle and screencast video with caption and subtitle.

2. This study focused on a screencast video explaining the provision of basic modelling using 3D modelling software.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi

3. Participants of this study consist of fifth semester students in the Bachelor of Design in Animation with Honours programme, from Universiti Pendidikan Sultan Idris.

05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi
05-4506832 pustaka.upsi.edu.my Perpustakaan Tuanku Bainun Kampus Sultan Abdul Jalil Shah PustakaTBainun ptbupsi