

TITLE IN CAPITAL LETTERS

TITLE IN CAPITAL LETTERS

TITLE IN CAPITAL LETTERS

ZAIDATUN TASIR

UNIVERSITI TEKNOLOGI MALAYSIA

**UNIVERSITI TEKNOLOGI MALAYSIA
DECLARATION OF THESIS**

I declare that this Choose an item. is classified as:

(If none of the options are selected, the first option will be chosen by default)

I acknowledged the intellectual property in the Choose an item. belongs to Universiti Teknologi Malaysia, and I agree to allow this to be placed in the library under the following terms :

This is the property of Universiti Teknologi Malaysia

The Library of Universiti Teknologi Malaysia has the right to make copies for the purpose of research only.

The Library of Universiti Teknologi Malaysia is allowed to make copies of this thesis for academic exchange.

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

Note: This page is only applicable for theses classified as Restricted/Confidential. Please delete this page from the template if your thesis is not classified as Restricted/Confidential. This letter should be written by a supervisor and addressed to Perpustakaan UTM. A copy of this letter should be attached to the thesis.

Date:

Librarian

Jabatan Perpustakaan UTM,
Universiti Teknologi Malaysia,
Johor Bahru, Johor

Sir,

CLASSIFICATION OF THESIS AS RESTRICTED/CONFIDENTIAL

TITLE: Click or tap here to enter text.

AUTHOR'S FULL NAME:Click or tap here to enter text.

Please be informed that the above-mentioned thesis titled _____ should be classified as RESTRICTED/CONFIDENTIAL for a period of three (3) years from the date of this letter. The reasons for this classification are

- (i)
- (ii)
- (iii)

Thank you.

Yours sincerely,

SIGNATURE:

NAME:

ADDRESS OF SUPERVISOR:

“Choose an item. hereby declare that Choose an item. have read this Choose an item.
and in Choose an item.
opinion this Choose an item. is sufficient in term of scope and quality for the
award of the degree of Choose an item.”

Signature : _____
Name of Supervisor I : ZAIDATUN TASIR
Date : 20 April 2026

Signature : _____
Name of Supervisor II : ZAIDATUN TASIR
Date : 20 April 2026

Signature : _____
Name of Supervisor III : ZAIDATUN TASIR
Date : 20 April 2026

Declaration of Cooperation

This is to confirm that this research has been conducted through a collaboration [Click or tap here to enter text.](#) **and** [Click or tap here to enter text.](#)

Certified by:

Signature :

Name :

Position :

Official Stamp

Date

* This section is to be filled up for theses with industrial collaboration

Pengesahan Peperiksaan

Tesis ini telah diperiksa dan diakui oleh:

Nama dan Alamat Pemeriksa Luar :

Nama dan Alamat Pemeriksa Dalam :

Nama Penyelia Lain (jika ada) :

Disahkan oleh Timbalan Pendaftar di Fakulti:

Tandatangan :

Nama :

Tarikh :

TITLE

TITLE

TITLE

TITLE

ZAIDATUN TASIR

A thesis submitted in fulfilment of the
requirements for the award of the degree of
Doctor of Philosophy

Faculty of Educational Sciences and Technologies
Universiti Teknologi Malaysia

APRIL 2026

DECLARATION

I declare that this Choose an item. entitled “*title of the thesis*” is the result of my own research except as cited in the references. The Choose an item. has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

.

Name :

Date : 20 April 2026

ACKNOWLEDGEMENT

The journey of completing this thesis has been both intellectually enriching and personally transformative. Along the way, I have been fortunate to receive guidance, encouragement, and kindness from many individuals.

First and foremost, I wish to express my heartfelt gratitude to Professor Dr. Zaidatun Tasir, my supervisor, whose dedication, wisdom, and unwavering support were instrumental throughout this research. Her insightful feedback, patience, and encouragement have helped me grow not only as a researcher but also as a critical thinker. I am truly privileged to have worked under her supervision.

I would also like to thank Universiti Teknologi Malaysia (UTM) for providing the financial support and resources necessary for the successful completion of my doctoral studies. My appreciation also goes to the library staff at UTM for their assistance in accessing essential references and academic materials.

To my fellow postgraduate students and research peers, thank you for the shared experiences, thoughtful conversations, and mutual support. These interactions have made the academic journey less solitary and more meaningful.

I am especially grateful to my family for their endless encouragement and patience throughout this long and demanding process. Their belief in me has been a constant source of strength.

This thesis is a reflection of many contributions, and although it carries my name, it belongs in spirit to all who have walked this path with me.

ABSTRACT

Reflective thinking is a vital skill in 21st-century education, enabling students to make informed decisions by critically evaluating information, knowledge, and experiences [The overall issue addressed in the thesis]. This study aims to explore how feedback can enhance students' reflective thinking skills through the use of educational blogging [Main aim or purpose of the study]. Reflective thinking often poses challenges for students without proper instructional support, and this study highlights feedback as a practical pedagogical approach to address this gap in both theory and classroom practice [Academic and practical importance of the study]. A 14-week study using a pre-experimental one-group pre-test post-test design was conducted with 18 postgraduate students, combining content analysis of blog reflections (qualitative data) and student performance scores (quantitative data) [Methodology used in the study]. Findings showed that most reflections were at basic levels (Descriptive Writing and Descriptive Reflection), but more advanced levels (Dialogic and Critical Reflection) occurred when students were engaged with thought-provoking content; feedback types such as Brainstorm and Application were most commonly used and contributed to reflective engagement [Main findings of the study]. The study identified 16 association rules and generated eight learning pathways that demonstrate how specific feedback types influence the development of reflective thinking and learning performance [Concluding statement to indicate the contribution made by the study]. These findings provide useful insights for students, instructors, and curriculum designers on how to effectively nurture reflective thinking through targeted feedback in online learning environments [Practical or managerial implications of the study].

(Note: Students are allowed to use either single or one-and-a-half spacing for the abstract, as long as it fits within one page. The chosen spacing style must be consistent across both the English and Malay sections.)

ABSTRAK

Pemikiran reflektif ialah kemahiran penting dalam pembelajaran abad ke-21 kerana ia membantu pelajar membuat keputusan dengan menilai secara kritis maklumat, pengetahuan dan pengalaman yang tersedia [The overall issue addressed in the thesis]. Kajian ini bertujuan untuk meneroka bagaimana maklum balas boleh meningkatkan kemahiran pemikiran reflektif pelajar melalui penggunaan blog pendidikan [Main aim or purpose of the study]. Pemikiran reflektif sering menjadi cabaran kepada pelajar tanpa sokongan pedagogi yang sesuai, dan kajian ini menekankan maklum balas sebagai pendekatan pengajaran yang praktikal untuk menangani kekurangan ini dari sudut teori dan amalan bilik darjah [Academic and practical importance of the study]. Kajian selama 14 minggu telah dijalankan dengan menggunakan reka bentuk pra-eksperimen satu kumpulan (pra-ujian dan pasca-ujian) melibatkan 18 pelajar pascasiswazah, dengan data dianalisis secara kualitatif melalui kandungan blog refleksi dan secara kuantitatif melalui skor prestasi pelajar [Methodology used in the study]. Dapatan menunjukkan bahawa kebanyakan pelajar berada pada tahap asas pemikiran reflektif (Penulisan Deskriptif dan Refleksi Deskriptif), namun tahap yang lebih tinggi (Refleksi Dialogik dan Kritikal) dapat dicapai apabila pelajar diberikan tugas yang mencabar; jenis maklum balas seperti Sumbangsan dan Aplikasi paling kerap digunakan dan berkesan dalam merangsang pemikiran reflektif [Main findings of the study]. Kajian ini telah mengenal pasti 16 peraturan berkaitan penting dan menjana lapan laluan pembelajaran yang menunjukkan bagaimana jenis maklum balas tertentu boleh mempengaruhi perkembangan pemikiran reflektif dan prestasi pembelajaran [Concluding statement to indicate the contribution made by the study]. Penemuan ini memberikan panduan berguna kepada pelajar, pensyarah, dan pereka kurikulum dalam usaha membangunkan kemahiran pemikiran reflektif melalui strategi maklum balas yang disasarkan dalam persekitaran pembelajaran digital [Practical or managerial implications of the study].

(Note: Students are allowed to use either single or one-and-a-half spacing for the abstract, as long as it fits within one page. The chosen spacing style must be consistent across both the English and Malay sections.)

TABLE OF CONTENTS

	TITLE	PAGE
	DECLARATION	iii
	ACKNOWLEDGEMENT	v
	ABSTRACT	vi
	ABSTRAK	vii
	TABLE OF CONTENTS	viii
	LIST OF TABLES	xii
	LIST OF FIGURES	xiii
	LIST OF ABBREVIATIONS	xiv
	LIST OF SYMBOLS	xv
	LIST OF APPENDICES	xvi
CHAPTER 1	INTRODUCTION	1
1.1	Introduction	1
1.2	Background of Problem	2
1.3	Problem Statement	2
1.4	Research Objectives	3
1.5	Research Questions	3
1.6	Theoretical Framework	4
1.7	Conceptual Framework	4
1.8	Importance of research	4
1.9	Research Scope	4
1.10	Operational Definitions	4
	1.10.1 Term 1	5
	1.10.2 Term 2	5
1.11	Summary	5

CHAPTER 2	LITERATURE REVIEW	7
2.1	Introduction	7
2.2	General Issues	7
2.2.1	Definitions	7
2.3	Previous Research on Research Variable 1	7
2.4	Previous Research on Research Variable 2	8
2.5	Critical Analysis of Research Gap	10
2.6	Theory 1	11
2.7	Theory 2	12
2.8	Critical Analysis of Research Instruments	12
2.9	Critical Analysis of Research Instruments	12
2.10	Summary	12
CHAPTER 3	RESEARCH METHODOLOGY	13
3.1	Introduction	13
3.2	Research Design	13
3.2.1	Internal and External Validity Threats (if your research uses experimental design)	13
3.3	Research Procedure	13
3.3.1	Stage 1: Pre Data Collection	14
3.3.2	Stage 2: Data Collection	14
3.3.3	Stage 3: Data Analysis	14
3.4	Population and Samples	16
3.4.1	Students	16
3.4.2	Teachers	16
3.4.3	Experts	16
3.5	Research Instruments	16
3.5.1	Questionnaire	16
3.5.2	Performance Test	17
3.5.3	Rubric	17
3.5.4	Observation Checklist	17

3.5.5	Interview Protocol	17
3.6	Pilot Study	17
3.6.1	Instruments Validity	17
3.6.2	Instrument Reliability	17
3.7	Data Analysis	18
3.7.1	Data Analysis of RQ1	18
3.7.2	Data Analysis of RQ2	18
3.7.3	Data Analysis of RQ3	18
3.7.4	Data Analysis of RQ4	18
3.8	Research Ethics	18
3.9	Research Plan	18
3.10	Summary	18
CHAPTER 4	RESULTS	19
4.1	Introduction	19
4.2	Background of Respondents	19
4.3	Finding of RQ1	19
4.4	Finding of RQ2	19
4.5	Finding of RQ3	20
4.6	Finding of RQ4	22
4.7	Summary	22
CHAPTER 5	DIACUSSIONS, CONCLUSION, AND RECOMMENDATIONS	23
5.1	Introduction	23
5.2	Research Overview	23
5.3	Discussion of RQ1 Finding	23
5.4	Discussion of RQ2 Finding	23
5.5	Discussion of RQ3 Finding	23
5.6	Discussion of RQ4 Finding	23
5.7	Conclusion	23
5.8	Contributions of Research	24

5.8.1	Theoretical Contributions	24
5.8.2	Empirical Contributions	24
5.8.3	Methodological Contributions	24
5.8.4	Practical Contributions	24
5.8.5	Policy Contributions	24
5.9	Implications of Research	24
5.10	Limitations of Research	24
5.11	Recommendations for Future Research	24
5.12	Summary	24
REFERENCES		27
LIST OF PUBLICATIONS		32
APPENDIX		33

LIST OF TABLES

TABLE NO.	TITLE	PAGE
Table 1.1	The role of statistical quality engineering tools and methodologies	4
Table 2.1	Critical analysis of previous studies on research variable 1	7
Table 2.2	Critical analysis of previous studies on research variable 2	9
Table 2.3	Critical analysis of previous studies on research gap	10
Table 2.4	Critical analysis of theories on ...	11
Table 2.5	Critical analysis of research instruments of...	12
Table 3.1	Internal and external validity threats	15
Table 3.2	Experts' profiles	18
Table 3.3	Samples of items of the questionnaire	18
Table 3.4	Mapping of research questions with data analysis techniques	20
Table 4.1	Background of respondents	22
Table 4.2	Findings of...	23
Table 4.3	Findings of...	25

LIST OF FIGURES

FIGURE NO.	TITLE	PAGE
Figure 1.1	Theoretical Framework	4
Figure 1.2	Theoretical Framework	4
Figure 2.1	Diagram 1 (Cheng, 2013)	11
Figure 2.2	Literature review map	12
Figure 3.1	Research Design	13
Figure 3.2	Research Procedure	15
Figure 3.3	Gant Chart	18
Figure 4.1	Chart 1...	19

LIST OF ABBREVIATIONS

ANN	-	Artificial Neural Network
GA	-	Genetic Algorithm
PSO	-	Particle Swarm Optimization
MTS	-	Mahalanobis Taguchi System
MD	-	Mahalanobis Distance
TM	-	Taguchi Method
UTM	-	Universiti Teknologi Malaysia
XML	-	Extensible Markup Language
ANN	-	Artificial Neural Network
GA	-	Genetic Algorithm
PSO	-	Particle Swarm Optimization

LIST OF SYMBOLS

δ	-	Minimal error
D, d	-	Diameter
F	-	Force
v	-	Velocity
p	-	Pressure
I	-	Moment of Inertia
r	-	Radius
Re	-	Reynold Number

LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Mathematical Proofs	27
Appendix B	Psuedo Code	28
Appendix C	Time-series Results	29
Appendix D	Time-series Results X	30

CHAPTER 1

INTRODUCTION

1.1 Introduction

1.5 pages only

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar. *“For the first paragraph, use ‘Para 2 lines’ style”*

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that *complement* each other. For example, you can add a matching cover page, header, and sidebar. Click Insert and then choose the elements you want from the different galleries. Themes and styles also help keep your document coordinated. When you click Design and choose a new Theme, the pictures, charts, and SmartArt graphics change to match your new theme. *“For the last paragraph/single paragraph in the section, use ‘Para 4 lines’ style”*

1.2 Background of Problem

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar. Click Insert and then choose the elements you want from the different galleries.

Themes and styles also help keep your document coordinated. When you click Design and choose a new Theme, the pictures, charts, and SmartArt graphics change to match your new theme. When you apply styles, your headings change to match the new theme. Save time in Word with new buttons that show up where you need them. To change the way a picture fits in your document, click it and a button for layout options appears next to it. When you work on a table, click where you want to add a row or a column, and then click the plus sign.

1.3 Problem Statement

One para – issue

One para –empirical gap

One para – theoretical gap

One para – Other gaps

One para – Conclusion

Therefore, this study analyses/explores...

1.4 Research Objectives

The objectives of the research are:

- (a) To estimate the parameters
- (b) Item 1
- (c) Item 2
- (d) To define the best parameter estimate.

1.5 Research Questions

The research questions are:

- (a) What is ...
- (b) Is there any significant...
- (c) Which ...
- (d) Why/How to ...

1.6 Theoretical Framework

There are several theories underpinned this research...

Figure 1.1 Theoretical framework

1.7 Conceptual Framework

The conceptual framework of this research is illustrated in figure 1.2

Figure 1.2 Conceptual framework

Table 1.1 The role of statistical quality engineering tools and methodologies

1.8 Importance of Research

The importance of research are...

1.9 Research Scope

1.10 Operational Definitions

Followings are the definitions of the important terms used in this research.

1.10.1 Term 1

1.10.2 Term 2

1.11 Summary

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter explains the ...

2.2 General Issues

2.2.1 Definitions

2.3 Previous Research on Research Variable 1

Table 2.1 presents the critical analysis of...

Table 2.1 Critical analysis of previous studies on research variable 1

No.	Authors (year)	Focus	Method	Findings	Gap

2.4 Previous Research on Research Variable 2

Critical analysis of previous studies was conducted and presented in table 2.2

Table 2.2 Critical analysis of previous studies on research variable 2

No.	Authors (year)	Focus	Method	Findings	Gap

2.5 Critical Analysis of Research Gap

Table 2.3 presents the critical analysis of...

Table 2.3 Critical analysis of previous studies on research gap

No.	Authors (year)	Focus	Method	Findings	Gap

From the analysis, the gaps can be summarized as followings:

- (a) Video provides a powerful way to help you prove your point.
- (b) When you click Online Video, you can paste in the embed code for the video you want to add.
- (c) You can also type a keyword to search online for the video that best fits your document.
- (d) To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other.
- (e) For example, you can add a matching cover page, header, and sidebar.

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document. To make your document look professionally produced, Word provides header, footer, cover page, and text box designs that complement each other. For example, you can add a matching cover page, header, and sidebar.

2.6 Theory 1

Table 2.4 presents the critical analysis of theories of...

Table 2.4 Critical analysis of theories on ...

No.	Authors (year)	Theories	Elements/ Principles	Strengths	Weaknesses

Figure 2.1 Diagram 1 (Cheng, 2013)

2.7 Theory 2

Figure 2.2 illustrates the literature review map of this study.

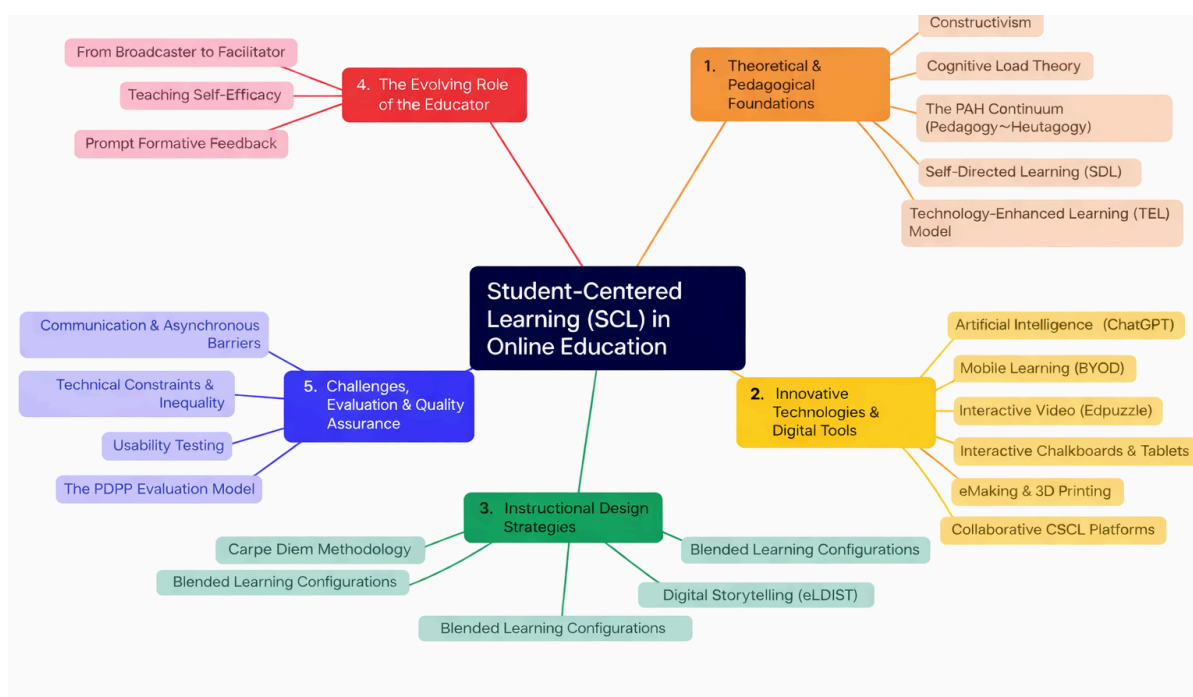


Figure 2.2 Literature review map

2.8 Critical Analysis of Research Instrument 1

Table 2.5 presents the critical analysis of theories of...

Table 2.5 Critical analysis of research instruments of...

No.	Authors (year)	Types of research instrument	Theory underpinned	Dimensions	Reliability/ Level of Users

2.9 Critical Analysis of Research Instrument 2

2.10 Summary

Click Insert and then choose the elements you want from the different galleries. Themes and styles also help keep your document coordinated. When you click Design and choose a new Theme, the pictures, charts, and SmartArt graphics change to match your new theme. When you apply styles, your headings change to match the new theme. Save time in Word with new buttons that show up where you need them.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter will discuss

3.2 Research Design

The philosophy of this research is positivism... Figure 3.1 shows the research design of this research

Figure 3.1 Research design

3.2.1 Internal and External Validity Threats (if your research uses experimental design)

Table 3.1 presents how this study addresses the internal and external validity threats associated with the chosen quasi-experimental design.

Table 3.1 Internal and external validity threats

No.	Internal Validity	Actions taken
1.	???	
2.		

No.	External Validity	Actions taken

3.3 Research Procedure

This research will be conducted through 3 stages/phases as illustrated in figure 3.2.

3.3.1 Stage 1: Pre Data Collection

3.3.2 Stage 2: Data Collection

3.3.3 Stage 3: Data Analysis

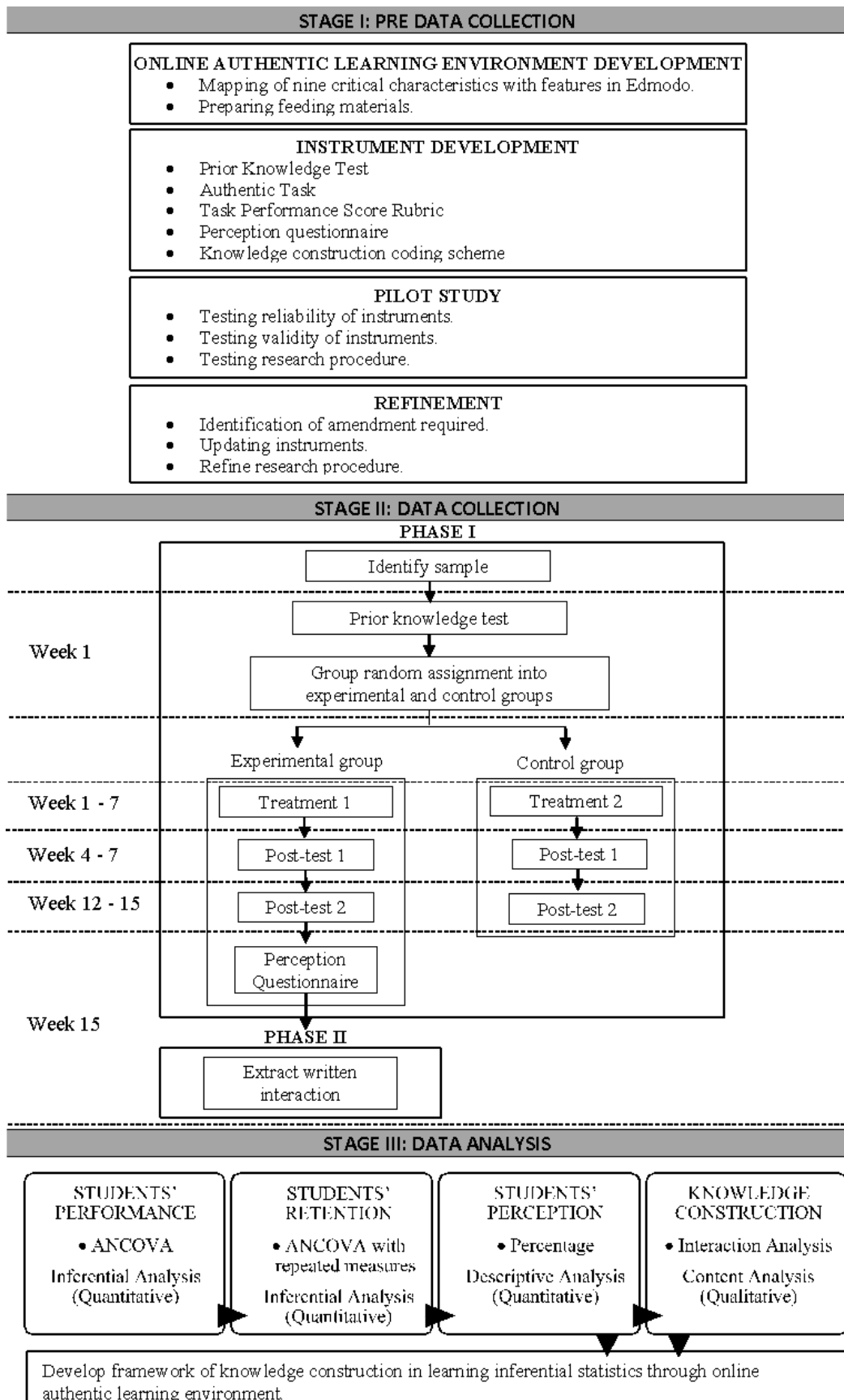


Figure 3.2 Research procedure

3.4 Population and Samples

3.4.1 Students

3.4.2 Teachers

3.4.3 Experts

Table 3.2 Experts’ profiles

No.	Experts	Working Experiences	Instrument Validation
1.	Expert 1	20 years of experience as a Professor in Educational Technology	Interview Protocol

3.5 Research Instruments

3.5.1 Questionnaire

Table 3.3 presents...

Table 3.3 Samples of items of the questionnaire

No.	Items	Constructs/ Dimensions	Sources
1.			Deng (2023)

3.5.2 Performance Test

3.5.3 Rubric

3.5.4 Observation Checklist

3.5.5 Interview Protocol

3.6 Pilot Study

3.6.1 Instruments Validity

3.6.2 Instrument Reliability

3.7 Data Analysis

3.7.1 Data Analysis of RQ1

3.7.2 Data Analysis of RQ2

3.7.3 Data Analysis of RQ3

3.7.4 Data Analysis of RQ4

Table 3.4 summarises the data analysis techniques that will be used to answer research questions.

Table 3.4 Mapping of research questions with data analysis techniques

No.	Research Question	Samples (n)	Instruments	Data Analysis
1.				

3.8 Research Ethics

3.9 Research Plan

	November				December				January				February			
Literature review																
Questionnaire design																
Conducting the survey																
Data presentation																
Analysing data																
Writing conclusions																
Finishing first draft																
Addressing feedback																
Completing study																

Figure 3.3 Gant chart

3.10 Summary

CHAPTER 4

RESULTS

4.1 Introduction

This chapter will discuss

4.2 Background of Respondents

Table 4.1 presents the demographic information of the respondents.

Table 4.1 Background of respondents

Demographic Variables	n	%	Total (%)
Gender			
Male	25	50	50 (100%)
Female	25	50	
Race			
Malay			
Chinese			
Indian			
Others			

4.3 Finding of RQ1

Figure 4.1 Chart 1...

4.4 Finding of RQ2

Table 4.2 Findings of...

[illegible]

4.5 Finding of RQ3

Table 4.3 Findings of...

Title	Title	Title	Title	Title	Title	Title

4.6 Finding of RQ4

4.7 Summary

CHAPTER 5

DISCUSSIONS, CONCLUSION, AND RECOMMENDATIONS

5.1 Introduction

5.2 Research Overview

5.3 Discussion of RQ1 Finding

5.4 Discussion of RQ2 Finding

5.5 Discussion of RQ3 Finding

5.6 Discussion of RQ4 Finding

5.7 Conclusion

5.8 Contributions of Research

5.8.1 Theoretical Contributions

5.8.2 Empirical Contributions

5.8.3 Methodological Contributions

5.8.4 Practical Contributions

5.8.5 Policy Contributions

5.9 Implications of Research

5.10 Limitations of Research

5.11 Recommendations for Future Research

5.12 Summary

Video provides a powerful way to help you prove your point. When you click Online Video, you can paste in the embed code for the video you want to add. You can also type a keyword to search online for the video that best fits your document.

REFERENCES

- Chen, M.-C., & Huang, S.-H. (2003). Credit scoring and rejected instances reassigning through evolutionary computation techniques. *Expert Systems with Applications*, 24(4), 433–441. <http://doi.org/10...>
- Clerc, M., & Kennedy, J. (2002). The particle swarm: Explosion, stability, and convergence in a multidimensional complex space. *IEEE Transactions on Evolutionary Computation*, 6(1), 58–73.
- Gosnell, M., Woodley, R., Hicks, J., & Cudney, E. (2014). Exploring the Mahalanobis-Taguchi approach to extract vehicle prognostics and diagnostics. In *IEEE Symposium on Computational Intelligence in Vehicles and Transportation Systems (CIVTS)* (pp. 84–91).
- Gupta, A. (2015). Classification of complex UCI datasets using machine learning algorithms using Hadoop. *International Journal of Scientific & Technology Research*, 4(5), 85–94.
- Hu, J., Zhang, L., Liang, W., & Wang, Z. (2009). Incipient mechanical fault detection based on multifractal and MTS methods. *Petroleum Science*, 6(2), 208–216.
- Huang, C.-L., Chen, Y.-H., & Wan, T.-L. J. (2012). The Mahalanobis-Taguchi system—adaptive resonance theory neural network algorithm for dynamic product designs. *Journal of Information and Optimization Sciences*, 33(6), 623–635.
- Jain, A. K., Duin, R. P. W., & Mao, J. (2000). Statistical pattern recognition: A review. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, 22(1), 4–37.
- Khalid, S., Khalil, T., & Nasreen, S. (2014). A survey of feature selection and feature extraction techniques in machine learning. In *2014 Science and Information Conference* (pp. 372–378).
- Li, C., Yuan, J., & Qi, Z. (2015). Risky group decision-making method for distribution grid planning. *International Journal of Emerging Electric Power Systems*, 16(6), 591–602.
- Ly, Y., & Gao, J. (2011). Condition prediction of chemical complex systems based on multifractal and Mahalanobis-Taguchi system. In *Proceedings of the*

- International Conference on Quality, Reliability, Risk, Maintenance, and Safety Engineering (ICQR2MSE 2011)* (pp. 536–539).
- Van der Maaten, L. J. P., Postma, E. O., & Van den Herik, H. J. (2009). *Dimensionality reduction: A comparative review* (Technical Report TiCC TR 2009-005).
- Motwani, R., & Raghavan, P. (1996). Randomized algorithms. *ACM Computing Surveys*, 28(1), 33–37.
- Song, Q., Ni, J., & Wang, G. (2013). A fast clustering-based feature subset selection algorithm for high-dimensional data. *IEEE Transactions on Knowledge and Data Engineering*, 25(1), 1–14.
- Rao, V. M., & Singh, Y. P. (2013). Decision tree induction for financial fraud detection. In *Proceedings of the International Conference on Artificial Intelligence in Computer Science and ICT (AICS 2013)* (pp. 321–328).
- Shi, Y., & Eberhart, R. (1998). A modified particle swarm optimizer. In *Proceedings of the IEEE International Conference on Evolutionary Computation* (pp. 69–73).
- Soylemezoglu, A., Jagannathan, S., & Saygin, C. (2011). Mahalanobis-Taguchi system as a multi-sensor based decision-making prognostics tool for centrifugal pump failures. *IEEE Transactions on Reliability*, 60(4), 864–878.
- Theodoridis, S., Koutroumbas, K., Holmstrom, L., & Koistinen, P. (2009). *Pattern recognition*. Wiley.
- Zaki, M. J., & Wong, L. (2003). Data mining techniques. *WSPC/Lecture Notes Series*, 10(1–2), 545.

APPENDIX

Appendix A Mathematical Proofs

Appendix B Psuedo Code

Appendix C Time-series Results

Appendix D Time-series Results X

LIST OF PUBLICATIONS

Journal Articles

- Qasem, S. N., Shamsuddin, S. M., Hashim, S. Z. M., Darus, M., & AlShammari, E. (2013). Memetic multiobjective particle swarm optimization based radial basis function network for classification problems. *Information Sciences*, 239, 165–190. <https://doi.org/10.1016/j.ins.2013.03.021>. (Q1, IF: 4.305)
- Qasem, S. N., & Shamsuddin, S. M. (2011). Radial basis function network based on time variant multi-objective particle swarm optimization for medical diseases diagnosis. *Applied Soft Computing*, 11(1), 1427–1438. <https://doi.org/10.1016/j.asoc.2010.04.014>. (Q1, IF:3.907)
- Shen, L. W., Asmuni, H., & Weng, F. C. (2015). A modified migrating bird optimization for university course timetabling problem. *Jurnal Teknologi*, 72(1), 89–96. <https://doi.org/10.11113/jt.v72.2949>. (Indexed by SCOPUS)

Conference Proceedings

- Muhamad, W. Z. A. W., Jamaludin, K. R., Ramlie, F., Harudin, N., & Jaafar, N. N. (2017). Criteria selection for MBA programme based on the mahalanobis Taguchi system and the Kanri Distance Calculator. In 2017 IEEE 15th Student Conference on Research and Development (SCORED) (pp. 220–223). IEEE. <https://doi.org/10.1109/SCORED.2017.8305390>. (Indexed by SCOPUS).

