

UNIVERSITI TEKNOLOGI MARA

**AN INVESTIGATION OF NON-ROUTINE
PROBLEM-SOLVING IN UPPER SECONDARY
MATHEMATICS: CONTENT ANALYSIS OF
TEXTBOOKS, STUDENT ACHIEVEMENT, AND
PERCEPTIONS**

AINUL AZRIN BIN ABU KASIM

Dissertation submitted in partial fulfilment
of the required for the degree of
Master of Education
(Mathematics Education)

Faculty of Education

August 2025

ABSTRACT

This study investigates the content of upper secondary school Mathematics and Additional Mathematics textbooks in Malaysia, focusing on the prevalence of routine versus non-routine problems and how this relates to students' achievement in solving non-routine mathematical tasks. Using a mixed-methods approach, the study involved three key instruments: content analysis of Form 4 and Form 5 textbooks, a student perception questionnaire, and a Non-Routine Test (NRT). Findings from the content analysis revealed that non-routine problems constituted only 2.18% of the total textbook questions, indicating a limited emphasis on open-ended and cognitively demanding tasks. Students' performance on the Non-Routine Test was low, with a mean score of 11.98 out of 40, suggesting significant challenges in tackling unfamiliar problems. Additionally, the study found a statistically significant but moderate positive correlation between students' attitudes toward non-routine problem-solving and their NRT scores. These results point to a disconnect between the KSSM curriculum's emphasis on higher-order thinking skills and the actual instructional materials used in classrooms. The study concludes that the underrepresentation of non-routine problems in textbooks may contribute to students' limited problem-solving capabilities, and calls for a realignment of textbook content with national curriculum goals to better foster mathematical thinking and critical reasoning.

ACKNOWLEDGEMENT

First and foremost, I express my deepest gratitude to God for granting me the strength, perseverance, and motivation to complete this research. Without His guidance, this journey would not have been possible.

I extend my sincere appreciation to my supervisor, Professor Dr. Parmjit Singh Aperapar Singh, for his invaluable guidance, encouragement, and insightful feedback throughout this research. His expertise and unwavering support have been instrumental in shaping this study.

I am also deeply grateful to all the school principles of the participating schools for their cooperation and for allowing me the opportunity to conduct my research. Their support has been crucial in the success of this study.

Lastly, I would like to express my heartfelt thanks to my family and friends, who have stood by me through every challenge, offering their unwavering support and encouragement. Their belief in me has been a source of strength and inspiration throughout this journey.

TABLE OF CONTENTS

	Page
AUTHOR’S DECLARATION	ii
ABSTRACT	iii
ACKNOWLEDGEMENT	iv
TABLE OF CONTENTS	v
LIST OF TABLES	viii
LIST OF FIGURES	x
CHAPTER ONE: INTRODUCTION	1
1.1 Introduction	1
1.2 Background of Study	2
1.3 Problem Statement	5
1.4 Research Objective	5
1.5 Research Question	6
1.6 Significance of the Research	6
1.7 Limitations of the Research	7
1.8 Definition of Terms	8
1.9 Summary	9
CHAPTER TWO: LITERATURE REVIEW	11
2.1 Introduction	11
2.2 Problem-Solving Skills	12
2.3 Non-Routine Mathematical Problem	14
2.4 Textbook Content Analysis	17
2.5 Conceptual Framework	18
2.6 Summary	20
CHAPTER THREE: METHODOLOGY	22
3.1 Introduction	22
3.2 Research Design	22
3.3 Population, Sample, Sampling Method	23

CHAPTER ONE

INTRODUCTION

1.1 Introduction

Mathematics is a core subject in Malaysia's national curriculum and plays a central role in developing students' logical reasoning, quantitative thinking, and problem-solving skills. In today's rapidly evolving world, mathematical proficiency is no longer limited to mastering formulas or calculations. Instead, it increasingly demands the ability to apply mathematical knowledge to unfamiliar and complex real-life situations. At the heart of mathematics education lies the skill of problem-solving—a cognitive process essential for building a strong conceptual foundation. As Ozrecberoglu, Aydın, and Aydın (2022) noted, solving mathematical problems requires advanced thinking abilities that go beyond routine procedures.

Despite the importance of problem-solving, Malaysia's performance in international assessments has raised ongoing concerns. In the Programme for International Student Assessment (PISA), Malaysian students have consistently scored below the OECD average in mathematics, with the 2018 results indicating weaknesses in applying mathematical knowledge in real-world contexts (OECD, 2019). Likewise, in the 2023 Trends in International Mathematics and Science Study (TIMSS), Malaysia's average mathematics score dropped to 411—below the international benchmark of 472 and a significant decline from the 2019 performance (The Star, 2024). These findings suggest that many students continue to struggle with non-routine problems that require creative reasoning and critical thinking.

These challenges persist despite Malaysia's multiple curriculum reforms. The shift from the Kurikulum Bersepadu Sekolah Menengah (KBSM) to the Kurikulum Standard Sekolah Menengah (KSSM) reflects the government's intention to emphasize Higher-Order Thinking Skills (HOTS) and equip students for 21st-century demands. However, the poor outcomes in PISA and TIMSS raise concerns about whether classroom instruction and learning resources are aligned with these goals. One possible reason for this disconnect is the content of school textbooks.

Textbooks serve as the primary instructional tool in most Malaysian classrooms, guiding both teaching and student learning. If these textbooks prioritize routine,