# A DISCOURSE ANALYSIS OF MALAYSIAN AND SINGAPOREAN FINAL SECONDARY LEVEL MATHEMATICS TEXTBOOKS

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# DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE DEGREE OF MASTER OF LINGUISTICS

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2016

# A Discourse Analysis of Malaysian and Singaporean Final Secondary Level

### **Mathematics Textbooks**

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### Abstract

This research is prompted by recent developments in i) Malaysia's world ranking in Mathematics and Science which has seen it slipping from 10<sup>th</sup> place to 26<sup>th</sup> in the 2011 Trends in International Mathematics and Science Study (TIMSS) results, ii) Malaysia's below average scores in the PISA 2012 tests (the bottom third spot out of 65 countries in Mathematics) and iii) studies showing Malaysian students being demotivated to study subjects that use English as the medium of instruction. Despite its close proximity and shared geo-social history, Singapore on the other hand has maintained very high ranking and standards in mathematics. These issues compel these research questions: How different is Singapore's mathematics textbook syllabus from Malaysia's mathematics textbook syllabus in terms of their discourse elements? How do they work together to engage the reader and form the intended understanding of the subject conveyed? In order to compare the discourse patterns found in both Malaysian and Singaporean mathematics textbooks, this research employs various linguistic frameworks proposed by Hyland (2005), Fairclough (2003), Kress & Van Leeuwen (2001), and Scollon & Scollon (2003) to make sense of the data. Preliminary findings and comparisons show that despite having similarities, the students responded differently to the materials presented.

Keywords: mathematics textbook, textbook discourse, reader engagement, metadiscourse, interdiscourse, multimodality, discourse analysis

# Analisa Wacana Buku Teks Matematik Menengah Atas daripada Malaysia dan Singapura

Mohd Nazriq Noor Ahmad

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### Abstrak

Penyelidikan ini dilakukan kerana 1) Kejatuhan Malaysia dalam Matematik dan Sains dari tangga ke-10 ke tangga ke-26 dalam keputusan Trends in International Mathematics and Science Study (TIMSS) 2011, ii) skor bawah purata dalam ujian PISA 2012 (Malaysia terletak di tangga ketiga terakhir daripada 65 buah negara dalam Matematik), dan iii) kaji selidik yang menunjukkan pelajar-pelajar Malaysia tidak bersemangat untuk mempelajari subjek yang menggunakan bahasa Inggeris sebagai bahasa pengantar. Meskipun berdekatan dan berkongsi sejarah geo-sosial, Singapura sentiasa dapat mengukuhkan kedudukannya di tangga teratas dalam matematik. Ini telah membawa kepada persoalan berikut: Berbezakah isi kandungan buku teks matematik Singapura daripada isi kandungan buku teks matematik Malaysia? Bagaimanakah elemen tekstual dalam wacana akademik berfungsi untuk merangsang minat pembaca dan membentuk pemahaman tentang subjek yang diajar? Penyelidikan ini mengupas dan membandingkan corak wacana yang dijumpai dalam buku teks matematik dari Malaysia dan Singapura. Idea-idea yang dicadangkan oleh Hyland (2005), Fairclough (2005), Kress & van Leeuwen (2001), dan Scollon & Scollon (2003) digunakan untuk mengkaji data. Kajian dan perbandingan awal menunjukkan meskipun kedua-dua buku teks mempunyai persamaan, para pelajar menunjukkan reaksi yang berbeza terhadap kandung buku-buku teks tersebut.

Kata-kata kunci: buku teks matematik, wacana buku teks, penglibatan pembaca, metawacana, interdiscourse, multimodality, analisa wacana

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For a better tomorrow.

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# Glossary

- GCE (*General Certificate of Education*) A set of academic qualifications with awarding bodies in the United Kingdom and several Commonwealth countries. Exams include the "O" levels and "A" levels, which are both regarded as the world standard.
- MOE Ministry of Education
- MOSTI Ministry of Science, Technology and Innovation
- NEP New Economic Plan
- PMR (*Penilaian Menengah Rendah*) A now-defunct exam compulsory for all Malaysian students before they attend upper secondary education. Has been replaced with PT3 (*Penilaian Tingkatan 3*) since 2014.
- PPSMI (*Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris*) A now-defunct Malaysian policy in which Science and Mathematics were taught in English in all primary and secondary schools. Started in 2003, officially phased out in 2012.
- SPM (Sijil Pelajaran Malaysia) The national final secondary level examination in Malaysia.

# Chapter 1

# Introduction

# 1.0 Introduction

"For the things of this world cannot be made known without knowledge of mathematics."

Mathematics is an important subject as it can influence one's employability. This is because mathematics is a subject that is useful in a variety of fields, ranging from computing to medicine (Brown and Porter, 1996). Careers in highly regarded fields such as engineering, accountancy and business require good grades in mathematics as a prerequisite (Quadling, 1982; Cardiff School of Mathematics, 2006). Thus, solid grounding in mathematics would make students more valuable in the job market.

Malaysia's world ranking in mathematics has been rapidly falling. Among the benchmarking tests used to rank countries worldwide in academic performance is the Program of International Student Assessment (PISA) test. Over the past few years, Malaysia's scores have been below average in the PISA test and are continually dropping. When Malaysia first participated in the PISA 2009+ Test, Malaysia was ranked at number 57, but in the PISA 2012 test, Malaysia dropped further to the bottom third spot out of 65 countries in mathematics (Chen, 2013). The nation has also fared badly in other worldwide benchmarking tests. According to the 2011 Trends in International Mathematics and Science Study (TIMSS), Malaysia's world ranking in Mathematics dropped during the 2003-2011 period, with Mathematics slipping from 10<sup>th</sup> to 26<sup>th</sup> place (Mullis et al., 2012). Even poorer neighbouring countries such as Vietnam rank higher than Malaysia in education despite being economically weaker, with rural Vietnamese students being said to outperform Malaysian students (The Malaysian Insider, 2014, March 25). Given this

– Roger Bacon

situation, there is a need to compare with another country in order to benchmark Malaysia's performance in this subject.



**Figure 1.1:** Malaysia's performance in the PISA 2012 test in comparison to neighboring countries. Note that poorer neighboring countries such as Thailand and Vietnam scored and ranked higher than Malaysia in the test. Image is taken from The Malay Mail Online (2013, December 3).

Many quarters, comprising teachers, parents and even government officials, have expressed concern over the current standards of the Malaysian education system and syllabi used in schools (The Malaysian Insider, 2012, December 14). Their main concern is whether or not the current education system in Malaysia is producing students who are on par with their peers from other countries. In a world that is becoming increasingly global, there is also an increasing need for education that helps people meet the world's demands. Despite growing concern in the country, Datuk Seri Idris Jusoh (then Second Education Minister, now Minister of Higher Education as of July 2015) claims that the current education system in Malaysia is of the same standard as United Kingdom, Germany and Australia. (The Star, 2015, February 21). However, when Malaysia fared badly in the Organization for Co-economic Development's (OECD) world ranking for mathematics, he claimed that the Malaysian education system cannot be compared to the world standard and international benchmarking tests as they are "unfair" for the country. (The Malaysian Insider, 2015, May 21). Despite claims that the Malaysian education system meets the world standard, when ranked by the Organization of Co-economic Development (OECD), Malaysia ranks far behind Singapore at #52, while Singapore ranks first. The OECD ranking is widely considered as one of the world standards.



Figure 1.2: Malaysia's working ranking in mathematics and science according to OECD, in comparison to Singapore. Image obtained from theantdaily.com

In contrast, Singapore has had high-rankings over the past few years, all the way from the primary level up to the tertiary level, and the country particularly excels in mathematics. The PISA 2012 results sees Singapore ranking at number one out of 44 countries in problem-solving tests for 15-year-olds (Zachariah, April 2014). The country also ranks at number two out of 65 countries in mathematics. Meanwhile, The QS World University Rankings from 2010-2013 and Times Higher Education Asia University Rankings placed Singapore at number one in South East Asia. Two of Singapore's universities, Nanyang Technological University (NTU) and National University of Singapore (NUS) were ranked among the top universities in Asia. Despite its meager size and lack of natural resources compared to Malaysia, Singapore has been recognized internationally for its education.

Regarding the effectiveness of Malaysian education, it must also be pointed out that Malaysian graduates have been facing challenges in securing employment in recent years (The Star, 2012, July 30). According to the Malaysian government statistics, 71,000 fresh graduates were unemployed in 2011 (The Malaysian Insider, 2015, July 26). As of 2015, 161,000 fresh graduates, in addition to those unemployed from previous years (which grew to around 400,000), have yet to secure jobs (The Malaysian Insider, 2015, May 12). The increasing number of unemployed fresh graduates point to possible problems in the country's education standards, and the education system as a whole.

This situation is particularly curious, as Singapore was originally once a part of Malaysia, thus sharing the same education roots. The English education system introduced by the British which was originally used in Malaysia prior to gaining independence in 1957 is regarded as being one of the best of its time (Jiang, 2015). However, after Malaysia and Singapore split, the education system in both countries have changed separately, and the disparity in the rankings and performance of both countries in education, in particular the subject of mathematics, are prevalent.

There are many concerns regarding mathematics education in Malaysia, such as the current standard of mathematics education in secondary schools and the benchmarking methods used in order to measure the current standard. An investigation involving a comparison of the policies, pedagogies and teaching styles in both countries would be very difficult and time-consuming, especially given how fast the education system in both countries are changing. Teaching style and the discourse in the classroom are also hard to investigate, as they are subjective and depend on the teachers and students, making the situation different from school to school. The only constant would be the official textbooks, as all schools must use the official textbooks of their respective countries. Plus, the national final secondary level examinations are based on the syllabus used in the textbooks. Thus, this leads to the main problems which are investigated in this dissertation. Are the discourse elements in these textbooks different? If they are the same, then why are the rankings of both countries very different? If they are different, in what ways are they different? Do the teachers and students in Malaysia and Singapore perceive the textbook discourse differently?

Past studies on Malaysian textbooks have primarily focused on policies and pedagogies, but studies on the discourse elements used, especially from a linguistic perspective, are scarce. In order to better understand this situation, this research aims to fill that gap by providing a comparative discourse analysis of the linguistic elements in both official Malaysian and Singaporean mathematics textbooks used in the national curriculum. These textbooks are to be used as primary sources of reference for both teachers and students. The textbooks used at the final secondary level are the main focus of this dissertation, as the linguistic elements in the discourse of the textbooks would give an insight into how the subject is disseminated in both countries.

# **1.1** Research Purpose and Questions

This research is a discourse analysis of both Malaysian and Singaporean mathematics textbooks at the final secondary level. It covers the examination of the textual and semiotic contents in the Malaysian and Singaporean textbooks. This research is primarily curious about the similarities and differences in terms of presentation, and the way upper secondary students and teachers respond to these elements in the textbooks. This research is driven by the following questions:

# i. What are the textual similarities and differences between Malaysian and Singaporean mathematics textbooks at the final secondary level?

This research question looks at the similarities and differences in textual contents between the two textbooks by looking the textual elements of both textbooks: metadiscourse, interdiscursivity and visual semiotic composition. A discourse analysis encompassing the three elements is done to discover the similarities and differences in textual contents between the two books.

### ii. How do students and teachers perceive these textual similarities and differences?

The second question aims to provide an in-depth understanding of how the students react towards the textbooks' contents. This is meant to provide supplementary insights to the answers from the first research question. Students and teachers from both countries are involved. Surveys are used to discover their sentiments towards the textbooks and their respective education systems as a whole.

# iii. What are the external factors which influence the perception of users towards the textbooks and the subject?

The final research question aims to provide a better understanding of why the textbooks are designed as such and reasons not found in the textbook which influence the students and teachers' perception towards the textbooks and mathematics. This is intended to compliment the answers from the previous research questions. This question involves a survey of the students and teachers' opinions.



# **1.2** Malaysia and Singapore: A Brief Introduction

Figure 1.3: Map of Malaysia, obtained from worldatlas.com. The South China Sea splits the country into two parts: West Malaysia and East Malaysia.

Situated south of Thailand, Malaysia is a Southeast Asian country which is split into two by the South China Sea. West Malaysia, which consists of 11 states, is situated on the mainland peninsular. Meanwhile, East Malaysia, which is consists of the states Sabah and Sarawak, is situated on the isle of Borneo, which is also shared with Brunei and Indonesia. According to the Department of Statistics, the current population of Malaysia is around 31 million, 16 million being male and 15 million being female. The Malays are the dominant race in the country, making up 50.1% of the population. The Chinese are the second largest race, constituting 22.6% of the country, with the Indians coming at 3<sup>rd</sup> (6.7% of the population). Bahasa Malaysia is the official language of the country, but the usage of English is widespread in urban areas and it is an official language in the state of Sarawak. Industrial trade and oil and gas are the main economy of the country, and Malaysia has a GDP growth of 6.0 as of 2015. The distribution of children and adult citizens in the country is balanced, and the country has a low number of elderly people, which comprises less than 15% of the population. Around 41.2% of the population are aged 25-54, which is the normal working age, and the remainder of the population are aged 55 and above.

It is worth noting that 45.7% of the population (roughly around 15 million people) is of schooling age, which makes education particularly important as they will continue to grow and eventually be a major part of the country. The high number is of particular concern, because they will eventually contribute to the nation's economic growth. Thus, the quality of education in the country is of utmost importance.

Meanwhile, Singapore is situated south of West Malaysia, separated from Malaysia by the Straits of Johor. It is an island city state with a population of 5.5 million as of 2014, according to the country's Department of Statistics. The Chinese make up 74.1% of the population, with the Malays coming in second at 13.4% and the Indians make up only a minority of the population at 9.2%. The nation's economy revolves around the service industry. Half the population (50.3%) is aged 25-54, which is the normal working age. It is

worth noting that 31.2% of the nation is of schooling age and only 18.5% of the population is above the age of 55.



Figure 1.4: Map of Singapore, taken from worldatlas.com

# **1.3** Mathematics Education and Policies in Malaysia and Singapore

Malaysia and Singapore are connected through shared history. Singapore was originally a part of Malaysia until its separation from Malaysia in 1965. Prior to achieving independence from United Kingdom in 1957, there were five different streams of education in Malaya – the former name of the country which consisted of the Malay Peninsula and Singapore. These were the Malay vernacular education, Chinese vernacular education, Tamil vernacular education, English vernacular education and religious education, with the

religious stream being the oldest of them all (Rashid, Lee, Mahayuddin and Noordin, 2014).

The vernacular streams other than the English vernacular education were limited and restrictive, due to the nature and purpose of the streams. For instance, the religious education stream, which began in form of *pondok* (malay word for "hut" or "shed", because classes were literally held at makeshift huts at night) schools in the 14<sup>th</sup> century, were only meant to provide students with religious knowledge so that they could carry out basic religious obligations (Rashid, Lee, Mahayuddin and Noordin, 2014). In the Malay, Chinese and Tamil vernacular streams, students only learnt subjects such as reading, writing and basic calculation skills. There existed an imbalance in education at the time, as not many Indians had education, and there was an influx of Chinese immigration into Malaysia as they could be free from educational restrictions at the time in their homeland, thus the British introduced English medium schools which were open to all ethnic groups (ibid.). In contrast to all the other vernacular streams, the English vernacular education allowed students to study all the way up to the tertiary level, and the stream featured a wide range of subjects, with Mathematics being one of the core subjects.

After achieving independence in 1957, the education system in Malaya went through many changes. The education system was revamped in order to give all students, regardless of background, the opportunity to study all the way up to the tertiary level. This was done because initially, only those from the English vernacular education stream were able to go up to the tertiary level, while others were deprived of such an opportunity. There were many attempts at creating a national education policy to replace the age-old system, though each policy recommendation met objection from different races (Mok, 1996; Rashid, Lee, Mahayuddin and Noordin, 2014).

After changing its name to Malaysia in 1963 and separating from Singapore in 1965, Malaysia went through several major changes, such as changes in the nation's leadership and the 13 May racial riots. This resulted in the incorporation of national ideologies into mainstream education in Malaysia. The 13 May racial riots also led to the separation of Singapore from Malaysia.

Singapore – now a country of its own – changed the education system which it formerly shared with Malaysia. This was because of the strong sentiment and belief that vernacular education streams would hinder development and lead to more problems, both in education and national unity (Kwong, Eng, & Yap, 1997). The nation also echoed the sentiment that English was important for development and being global, thus English was made the official medium of instruction of education and in Singapore, with the purpose of uniting the various races in the nation and to avoid the problems of a racially-based vernacular system (Kwong, Eng & Yap, 1997; Gopinathan, 1997). Then Prime Minister of Singapore, Lee Kuan Yew was quoted saying that having four different racially-based vernacular streams would produce four completely different groups of people which could never be united, hence the need for only one vernacular stream (Gopinathan, 1997). Other languages, such as Mandarin, Malay and Tamil, were taught as second languages in Singapore. Thus, independence from Malaysia marked a divergence between Malaysia and Singapore in their education systems.

# 1.4 Final Secondary Level Examinations in Malaysia and Singapore

The final secondary level examination in both countries are of utmost significance, as the results of the examination will greatly influence the students' choices with regards to tertiary education and career pathways. Originally, both nations used the international

standard CGE O Level examination as the final examination for secondary level education. The GCE O Level was first introduced in 1951 and its introduction influenced the teaching methods of science, mathematics, and language. Despite its influence on teaching methods, the syllabuses for GCE examinations are merely examination syllabuses, not teaching syllabuses (Deakin, 1970). In 1978, the Malaysian government decided to introduce its own national final secondary level examination, the Sijil Pelajaran Malaysia (SPM). This marked a shift in Malaysia's education system, as benchmarking and syllabi for the examination were no longer based on international standards, but were instead based on standards set by the then newly established Majlis Peperiksaan Malaysia (MPM -Malaysian Examination Council). The medium of instruction for the syllabi, as well as the language used in the examination, is the national language, Bahasa Malaysia. Under this system, Malaysian students undergo 11 years of schooling - 6 years (Standard 1-6) in primary school, and 5 years (Form 1-5) in secondary school. A number of schools offer an additional grade in secondary school, known as Form 6, with its own national final level examination, known as Sijil Tinggi Pelajaran Malaysia (STPM - Malaysian Higher Education Certificate, equivalent to the GCE A Level examination). However, it is not considered as a mainstream choice in the country as only selected schools offer Form 6 and examination as an option.



Figure 1.5: Flowchart of the Malaysian Education System, taken from the Malaysian Ministry of

Education's website. The flowchart shows the grades and classes a typical Malaysian student

undergoes, as well as the time each major national examination is taken.

The education system used in Malaysia as of 2015 is similar to the education system used after independence, with only revisions to the language of instruction for mathematics and science, as well as the name of the curriculum system and examinations. All subjects except for language subjects were taught in Bahasa Malaysia, the national language. In 2003, the PPSMI (Pengajaran dan Pembelajaran Sains dan Matematik dalam Bahasa Inggeris – The Teaching of Mathematics and Science in English) policy was introduced, with the intention of making local students more global and marketable by teaching mathematics and science in English. This policy was met with heavy opposition and was thus initially reversed in 2012. However, exam papers for mathematics and science are now bilingual in Malaysia, and schools may opt to teach the subject in English or Malay, though most schools teach using a mixture of both languages and the students answer in primarily Bahasa Malaysia. Qualification-wise, teachers in the country normally require only a certificate or degree in education related to the field they are teaching to be a teacher in the country, thus the teacher's training has a huge influence on what language is used and how the subjects are taught.

Meanwhile, Singapore continues to use the GCE O Level as the final secondary level examination in the country. English is the medium of instruction for all subjects. While syllabi and medium of instruction are heavily influenced by racial demands in Malaysia, in Singapore, choices regarding policies and pedagogies are made based on comparisons and benchmarking tests by international bodies. All teachers must undergo special training and courses organized by the nation's National Institute of Education, and only the top 1/3 of the graduates are chosen to be teachers. The government regularly assesses the quality and performances of the teachers to ensure that all subjects are taught in line with the mission and vision of the nation.





Singaporean students spend fewer years in school compared to their Malaysian counterparts. While they spend 6 years in primary school just like in Malaysia, in secondary school, Singaporeans normally spend only 4 years (Form 1-4) before sitting for the GCE O Level Examination. This marks a difference between the two countries, as it appears that despite spending a year less in school, Singaporean students are better achievers compared to their Malaysian neighbours. For this reason, the Malaysian Form 5 mathematics textbook and Singaporean Form 4 mathematics textbook are compared, to discover if there are any textual similarities and differences which may have led to this.

### Chapter 2

### Literature Review

# 2.0 Introduction

This chapter is written with the purpose of developing a theoretical foundation and understanding of important key concepts and issues which will be used throughout this research. This is in order to answer the research questions found in Section 1.1. This chapter discusses the following concepts:

- 2.1 Academic Discourse
- 2.2 The Mathematics Textbook as a Genre
- 2.3 Textual Elements of Discourse
  - 2.3.1 Metadiscourse Markers
  - 2.3.2 Interdiscursive Elements
- 2.4 Visual Semiotic Elements

# 2.1 Academic Discourse

There are many different views on discourse, but this dissertation shall only focus on several which are used in the data analysis. In the context of this research, a discourse is determined by the setting, as the way language is used in specific situations, or discourses, are different (Gee, 1999). A discourse typically has its own setting in which it is used, and within that setting, ideas are communicated depending on specific needs and requirements. It is this setting which determines the changes within a discourse.

The language found in textbooks is different from what is normally used in everyday conversations and situations, and is a part of academic discourse. The language of academic discourse has its own unique patterns and writing conventions which come in many different varieties, meant to distinguish it from non-academic language (Thonney, 2011). The purpose of having a different language style is to disseminate specific academic rhetoric and ideas. Different subjects within academic discourse feature different styles. Academic discourse is purposefully written in a different manner to give it a higher status compared to other forms of information, representing knowledge and intellectual achievement. This is because one's grasp of a particular academic discourse becomes a measure of mastery of a particular subject (White & Lowenthal, 2011). In other words, the more one understands the subject's academic discourse, the more well-versed a student will be in the subject.

The academic discourse is a medium in which very specialized messages are constructed and communicated. Because of this, as Gee (1996) puts it, discourses are seen as worlds of their own, and within that world, new ideas are created and dissected to engage in the creation of new information, or in a sense, a process of "word building". In other words, the language found in the discourse creates its own domain, containing concepts and meanings which are exclusive to it and not found elsewhere. In this sense, Gee (1999) posits the seven areas of reality which are constructed in discourse: significance, social practices, identities, relationships, politics, connections and knowledge. Thus, a discourse is able to contain ideas of its own which are identifiable from how the language is used within that particular discourse.

Meanwhile, discourse allows people to know specific social practices (van Leeuwen, 2008). In practice, this means that discourses not only transmit messages within a community, but also represent the ideas and practices within a certain context. Thus, a mathematics textbook would be transmitting specific ideas from the mathematics

community to a specific audience involved in the process of learning mathematics. The content and syllabi of mathematics is highly specialized in nature due to its linguistic style, usage of formulas and graphics, so the position of mathematics textbooks within academic discourse needs to be further distinguished and defined.

# 2.2 The Mathematics Textbook as a Genre

While this research is not a form of genre analysis, the notion is used as we shall treat mathematics textbooks as a specific genre of academic discourse in this research. The concept of genre is very much intertwined with discourse and textual elements. Bhatia (2002) outlined the Genre-Discourse Framework, which establishes the relationship between social practice, genre and text in discourse. According to this framework, a discourse can be a social practice, genre or text, depending on the context. This dissertation focuses on the concept of discourse as a genre. A discourse is a genre when it is defined in terms of a disciplinary culture, in this instance, the academic discipline. The usage of specific terms in the academic world and implementation specific practices set the academic genre apart from other genres.

Genre is varied – it may consist of anything, ranging from abstracts, journals, dissertations, proposals and many others (Ding, 2007). As long as it is distinguished from other parts of discourse by any means, it is a distinct genre. Genres constitute a more specific, particular form of discourse, and genres are related to each other through the sharing of the same structure and style (Swales, 1990). This is because within a discourse, there is a need to further distinguish information which is highly specific and specialized in nature. What distinguishes one genre from another is how different genres have their own communicative purposes for a very specific audience (Luzon, 2005). These purposes then

define and shape the way the language is structured, and it also influences the linguistic choices within a genre.

A particular genre is influenced by factors such as time and space, and because of this, there are different expectations of different genres which vary from person to person and these expectations change over time (Swales, 1981). These factors make genre dynamic and constantly changing, depending on the context it is explored in. By looking at the specific aspects of a genre, researchers are able to grasp the social and individual construction of ideas within a particular discourse (Bhatia, 2002). An understanding of the way genres are constructed is important to understand the way language and textual elements are used in written form and books (Hyland, 2004). The mathematics textbook is a genre of its own, as it has a very specific purpose (to disseminate a syllabus) for a specific audience (students and teachers), and there are different expectations of it from different quarters (government, parents, teachers and students).

Another consideration that needs to be emphasized is on the curriculum materials used in mathematics teaching, as the materials used in class shapes the context of this genre. Remillard (2000) found that curriculum materials can create new learning opportunities for both teachers and students, especially if the teachers are interested in using them. These new opportunities can be created through the contents of the textbook, but these contents will not be able to materialize if the teacher does not use them in class. Not all teachers were found to have fully utilized curriculum materials. Collopy (2003) found that these materials can help, but they largely depend on the teachers' dynamic to allow the materials to be helpful. If a teacher does not make the effort to incorporate the materials in class, the materials would not be of any use. As past research have shown that not all teachers may rely on materials to teach, thus this study only focuses on the textbook,

as is the constant element which is present in mathematics education. The national final secondary level examinations in both Malaysia and Singapore are based on the syllabus and contents of their respective official textbooks. Hence, the element that will be looked into in the analysis of the textbooks is the discourse element.

## **2.3** Textual Elements of Discourse

The main elements which characterize the domains of a genre are the usage of textual elements and how each element is placed within the context of the genre (Fairclough, 2002). The content and textual elements of mathematics textbooks are different compared to other genres of academic discourse. Mathematics textbooks feature distinct textual elements which are predominantly used throughout the genre, including specific symbols, diagrams and formulas which are not found elsewhere (Devlin, 2000). Through these textual elements, the understanding of the particular discourse is disseminated to the intended audience. However, the meaning within a discourse may be interpreted differently if the reader does not possess the knowledge for a particular discourse (Hyland, 2004). The process of negotiating and understanding the meaning-making which goes on within a genre can be seen through a closer investigation of the textual elements within.

Perhaps the most important part of a discourse is the text itself and the textual elements within it (Van Dijk, 1997; Fairclough, 2003). This is because textual elements have the ability to change one's beliefs, knowledge, attitudes, and even values, as the text is a part of language which is connected to aspects of social life (Halliday, 1994). Thus, the textual elements can be considered as a central element of a genre. This is because the textual elements play a role in meaning-making (Fairclough, 2002). Textual elements are able to imply relationships between ideas, and they also identify relevant ideas and convey

the judgment of such ideas within the particular social setting which uses the discourse. They are essentially ways of representing the world through the worldview intended for a particular discourse (Fairclough, 2002). Thus, an analysis of textual elements in a discourse allows for a greater understanding of how ideas are reflected within the discourse. It also provides a window into understanding the possible social effects of the discourse (Van Dijk, 1997). By understanding the way textual elements are presented, one gains more insight of how information is disseminated.

Bhatia (2002) posits that an analysis of textual elements is well suited for textbooks used in schools. Many different studies employing various aspects of discourses and different frameworks of linguistic analysis have been done to better understand mathematics textbooks. Out of the many different frameworks which linguistics has to offer to researchers, O'Keefe and O'Donoghue (2012) found that discourse analysis is a viable framework for textbook analysis research, because of the scope and range offered by discourse analysis. Discourse analysis allows for a better understanding of social practices, knowledges and even language usage.

Discourse analysis has been used in a number of past researches involving mathematics textbook discourses to better understand the effectiveness and efficiency of the materials presented. Herbel-Eisenmann and Wagner (2005) had carried out a discourse analysis on mathematics textbooks used in secondary schools. They found that discourse used in the textbook allowed learners to better relate what they've learned in class with their everyday lives, as the discourse has fulfilled its role in disseminating specialized knowledge. Thus, this establishes the textbook as an important tool in mathematics education. Studies which compare the discourses in the mathematics textbooks of two countries are scarce at the time of writing. One notable study was done by Alshwaikh and Morgan (2013), who used discourse analysis in their comparison of Palestinian and British secondary school mathematics textbooks. They have chosen to focus on the multimodal perspective, and they have found that despite covering the same topics and content in both textbooks, they are differently represented in the textbooks, due to cultural factors. It was found that the two books engaged the readers in different ways. While both books construed the reader as a learner, the Palestinian book used specialized discourse to convey its message, while the British book relied on bringing in other discourses via interdiscursivity to shape an understanding of the contents of the book.

It is clear that there are many possibilities which can be explored via discourse analysis of textbooks. From recent research in this area, various aspects of discourse analysis have been used, and each approach yields different results. The majority of researches have employed content analysis and multisemiotic approaches, focusing on teachers and students. Due to the variety of ways to look at the discourse of textbooks, there needs to be a way to be more specific in analyzing its textual elements. This necessitates the need to look at a more specific aspect of discourse which we will explore in the following section.

# 2.3.1 Metadiscourse Markers

One of the specific aspects of discourse is the usage of words and phrases which aid readers to understand the knowledge disseminated. This is better known as metadiscourse. Metadiscourse is relevant in mathematics textbooks, as mathematics discourse in itself is highly technical in nature. Such technical information is not easy for readers to relate to, especially if they are not familiar with them. Content can be made much clearer using metadiscourse, as it helps make text more accessible (Toumi, 2009), more stimulating and engaging (Crismore, 1989), makes content easier to remember and more memorable (Crismore, 1990), and improves in overall understanding of a particular discourse (Camiciotolli, 2009).

Metadiscourse is dependent on the context. It is normally found in texts, verified through words, sentences and paragraphs (Kumpf, 2009). The lack of metadiscourse would make texts less cohesive, for instance, the omission of phrases such as "the next section discusses" (Kumpf, 2009). Therefore, the main purpose of metadiscourse is to make text more helpful for readers.

Williams (1981) states that metadiscourse can be found in everything that is written in the text. Visuals are part of the text itself and affects how one understands the text. As such, visual elements can also be considered as part of metadiscourse (Kumpf, 2009). As long as the visual elements are intended to interact with the reader to aid in the understanding of the main text, it can be considered as metadiscourse.

Metadiscourse also aims to compel readers to access their own background knowledge. Grabe and Kaplan (1996, pp. 207-211, in Hyland, 2005) highlight five parameters of this knowledge: i) the number of readers, ii) degree of closeness to the reader, iii) relative status of readers, iv) extent of shared background knowledge, and v) extent of specific topical knowledge shared. Different categories of metadiscourse markers are meant to make readers access the different parameters of their background knowledge. For instance, in one part of the text, the writer may intend for readers to access their current knowledge of the subject. In other parts, the writer might want readers to access knowledge of other topics to be related to what they are currently reading. The choice of metadiscourse

markers not only depend on what the writer intends, but also what the writer assumes about the readers.

Therefore, we can establish that metadiscourse is a way to organize the writer's perspective within a discourse. This is because it gives the power to the writer to shape the arguments within to cater to the needs of the audience (Hyland, 2004). In a sense, it means that the writer can make the text easier for readers to understand. As Schiffrin (1980) puts it, through metadiscourse, a writer is able to make the discourse more specific by having 'a voice within'. Through the writer's voice, the reader obtains an expression of what these ideas are. Depending on how metadiscourse markers are used, readers are also able to tell a lot about the writer and the writer's style within a particular genre and discourse (Hyland, 2004). Metadiscourse also allows readers to see how every part of the text is related to what they should know. This is done through the attitudes which are expressible via metadiscourse (Crismore, 1989). Studies on academic textbooks using metadiscourse have found that by using metadiscourse, writers are able to show how information should be interpreted (Crismore, 1989). As metadiscourse is used when referring to one's thinking and to the reader's act of reading (Williams, 1995), it is not uncommon for authors to refer to themselves, readers or the texts. This form of referral is done using words such as "to summarize", "on the contrary" and "I believe".

Hyland (2005) defines metadiscourse as a term for self-reflective expressions which are used in the negotiation of interactional meanings in a text. Metadiscourse plays a role in helping writers express their views and engage with readers. Following Hyland and Tse (2004), there are three key principles that underpin metadiscourse. They are:

i. Metadiscourse is distinct from propositional aspects of discourse.ii. Metadiscourse refers to aspects of the text that encapsulates writer-reader

interactions

iii. Metadiscourse refers only to relations in the discourse.

Meanwhile, the following table highlights the model of analysis proposed by Hyland (2005). The model divides metadiscourse into two dimensions of interaction: the interactive dimension, which includes resources that shape the text for the reader, and the interactional dimension, which includes resources that make the writer's views explicit to the readers.

Category	Function	Examples
Interactive	Help to guide the reader through	Resources
	the text	
Transitions	Express relations between main	In addition, but, thus, and
	clauses	
Frame Markers	Refer to discourse acts, sequences	Finally, to conclude, my purpose
	or stages	is
Endophoric Markers	Refer to information in other parts	Noted, above
	of the text	
Evidentials	Refer to information from other	According to X, Z states
	texts	
Code glosses	Elaborate propositional meanings	Namely, e.g., such as, in other
•		words
Interactional	Involve the reader in the text	Resources
Hedges	Withhold commitment and open	Might, perhaps, possible, about
	dialogue	
Boosters	Emphasize certainty or close	In fact, definitely, it is clear that
	dialogue	
Attitude markers	Express writer's attitude to	Unfortunately, I agree,
	proposition	surprisingly
Self-mentions	Explicit reference to author(s)	I, we, my me, our
Engagement markers	Explicitly build relationship with	Consider, note, you can see that
	reader	

**Table 2.1:** Hyland's (2005) model of metadiscourse

This dissertation does not intend to go into the reasons each metadiscourse marker is used, as that would involve needing to interview the authors of the textbooks analyzed in this study, who could not be reached. Instead, this dissertation intends to categorize the types of metadiscourse markers in each textbook to see how the textbooks are similar and how they differ. Each category of metadiscourse markers are used for different purposes based on Hyland's (2005) model. According to Hyland (2005), transitions are conjunctions which are used to show sequence and steps within a discourse, while frame markers are used by authors to set boundaries and indicate a shift in topic, and endophoric markers refer to other materials available in other parts of the text. Hyland (2005) refers to evidentials as the source and origin of information, while code glosses allow authors to elaborate meaning. Hedges are used to show a writer's reluctance, and boosters allow authors to express certainty while attitude markers allow them to express other feelings such as surprise and dismay towards the text (Hyland, 2005). Hyland (2005) also states that engagement markers let the authors directly address the reader, and self-mentions allow authors to establish their presence within a text.

There is however a problem with this model. Hyland (2004) and Hyland & Tse (2005) have found the definitions of each category are blurred and fuzzy, and highly reliant on readers' knowledge and perception of the words. Also, metadiscourse markers can be either words or phrases. Hyland (2004) explains that to counter this, words and phrases are counted as one metadiscourse marker as long as they are fulfilling the role and purpose of one marker. Because many words can fall under several categories, the meaning of the words need to be checked within the context and compared with meanings in dictionaries. Researchers then perform a frequency count of metadiscourse markers in order to analyze patterns of meaning-making, and compliment the data with interviews with readers (Hyland, 2004).

Metadiscourse helps greatly in facilitating readers in understanding a discourse. However, within a discourse, there are instances where other discourses may be present. Thus, there is a need to define another important concept: interdiscursivity.

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### **2.3.2** Interdiscursive Elements

Within a particular genre of discourse, it is not unusual for different discourses to be mixed in. Other discourses may find themselves being assimilated into another discourse, and oftentimes, the boundary between different discourses within a genre. This phenomenon of other discourses being present together is called interdiscursivity (Fairclough, 2002). Other discourses are included with a genre to add more context and explanation for readers.

Interdiscursivity allows for mixing of various genres and discourses within a discourse. The analysis of interdiscursive elements allows analysts to discover what Fairclough (2002) terms as "processes of social change". In the context of this dissertation, an analysis of interdiscursivity allows us to see how other discourses are used in an academic discourse to create a better understanding of the subject.

However, there is a need to distinguish the discourses which are introduced in texts through interdiscursivity. The elements that mark the different discourses are the linguistic features and vocabulary (Fairclough, 2002). Different discourses are identified this way. To identify the discourses, dictionaries are able to show which vocabulary belongs to which discourse (Sinclair, 2004), as the vocabulary of different discourses are distinct.

# 2.4 Visual Semiotic Elements

Mathematics textbooks do not contain just words, but also visuals such as graphs and charts. Textual elements and these images have a relationship in meaning-making, as they to have a role in representing ideas and showing how things are done (Kress & van Leeuwen, 1996). The way images are arranged brings about different meanings to the textual content. However, visual elements is a very wide field (Scollon & Scollon, 2003), thus we shall focus on a visual semiotic element which plays the biggest role in meaning-
making in textbooks: visual semiotic composition. Visual semiotic composition aids in the meaning-making process by adding additional meaning which text alone could not provide.



Figure 2.2: Visual semiotic composition system, as proposed by Kress and van Leeuwen (1996)

Following Kress and van Leeuwen's (1996) framework, the composition within the books and images allow for the composition of three different systems, which are:

1. **Information value:** The placement of elements endows them with the specific informational values attached to the various zones of the image: left and right, top and bottom, center and margin.

2. **Salience:** The elements are made to attract the viewer's attention to different degrees, as realized by such factors as placement in the foreground or background, relative size, contrasts in tonal value or color, differences in sharpness, etc.

3. **Framing:** The presence or absence of framing devices disconnects or connects elements of the image, signifying that they belong or do not belong together in some sense.

Framing can also be done through the usage of the triptych structure, which can be either horizontal or vertical. According to Kress & van Leeuwen (1996), the connected "rhythm" of frames has a role in composition. A triptych is a frame divided into different parts. When the parts are arranged from left to right (horizontal triptych), the part on the left is "given", the middle is "mediator" and the part on the right is "new". When the parts are arranged from top to bottom (vertical triptych), the part at the top is "ideal" and the part at the bottom is "real".

Mediator	New
	Mediator

Figure 2.3: Horizontal triptych structure, as proposed by Kress & van Leeuwen (1996).

Kress & van Leeuwen (1996) and Scollon & Scollon (2003) have highlighted that for the framework, the textual elements and visuals should not be treated separately, but rather as interacting together to create meaning. In other words, the way elements are arranged on the page of a book brings about different meanings and perceptions.

#### Chapter 3

#### **Research Methods and Methodology**

#### **3.0** Introduction

The purpose of this chapter is to outline the methods used to analyze data for this research, in order to answer the research questions presented in Chapter 1. This research uses two main research designs: text analysis research design and survey analysis research design. Section 3.1 discusses the research design for textbook analysis. Meanwhile, Section 3.2 discusses the survey analysis conducted on the relevant stakeholders of the textbooks. This is to compliment the results of the textbook analysis.

#### 3.1 Text Analysis Research Design

The first part of the research involves analyses of the textual elements of both Malaysian and Singaporean final secondary level mathematics textbooks. Three different textual elements are looked into, which are metadiscourse markers, interdiscursive elements, and visual semiotic composition. The text analysis carried out on the discourse uses the content analysis approach, as per Babbie (2008), as the data is already readily available. After deciding on which part of the data to observe and codify, the data is then interpreted based on frameworks selected by the researcher. The main advantage of using this approach is that very minimal time and money is spent, and due to its unobtrusive nature, it is easy to recheck data should any errors be made in the analysis process. The main disadvantage however is that findings are strictly limited to the data only. To overcome this disadvantage, a questionnaire survey is distributed to those who use the textbooks – teachers and students – in order to supplement the data from analysis of the textbook. While the analysis focuses on inter-related concepts, the three concepts require three separate frameworks of analysis. Thus, there is a need to connect them together in order to establish the relationship between all textual elements, as well as to justify the usage of three different frameworks and analysis of three different textual elements. Creswell (2003) proposes the usage of a visual model to tie in different inter-related set of constructs which are used in analysis. The following is a visual model of analysis done in this research, loosely based on Creswell's (2003) visual model concept:



Figure 3.1: Visual model of textual analysis on textual similarities and differences in Malaysian and Singaporean final secondary level mathematics textbooks.

The visual model in Figure 3.1 shows the three different strategies examined in this dissertation which are used to form the discourse in the textbooks. These strategies are chosen as they are the textual elements which may differ in a genre of textbooks where the topics of the subject matter are standard across different countries. The textual similarities and differences between the two textbooks are compared for each strategy highlighted in

the model, following Alshwaikh and Morgan (2013). This section is divided into three subsections which look at each of the strategies used in both textbooks.

# 3.1.1 Data: Textbook Data

*Mathematics Form 5* (see Figure 3.2) is the final secondary level mathematics textbook used in Malaysia. The textbook is published by Awan Metro, a private company which has been licensed by the Malaysian government to publish official academic textbooks for secondary level students. The book was first published in 2006, and is currently in its third edition. The book has 10 chapters and spans 334 pages. It is co-authored by a team of five people: Rozaili Mohd Ali, Yong Kiang Yeow, Saripah Ahmad, Markonah Kusnin, and Siti Zuraidah Md Bashah. It is worth noting that the acknowledgements section credits a team of panel readers for "valuable input" and an editorial team for providing "in-depth research". The publishers of the book could not be reached to obtain any additional information, as the all the contact numbers provided were no longer in service, while the e-mail address provided was found to be invalid.



Figure 3.2: Cover of Mathematics Form 5 official textbook, used in Malaysia.

Meanwhile, the final secondary level mathematics textbook used in Singapore is *Mathematics Secondary 4* (see figure 3.3). The textbook is published by Shinglee Publishers Pte Ltd. The Singaporean government has authorized the company to publish official academic textbooks for secondary level textbooks. The book was first published in 1982, and is currently in its 6<sup>th</sup> edition (published in 2008). The book consists of 6 main chapters and one revision chapter, and has a total of 380 pages. The authors are Teh Keng Seng (Bsc, Dip Ed), Loh Cheng Yee (BSc, Dip Ed), Joseph Yeo (MEd, PGDE (Distinction), BSc (Hons), and Ivy Chow (MEd, PGDE, BSc), with Dr Yeap Ban Har acting as consultant.



Figure 3.3: Cover of Mathematics 4 official textbook, used in Singapore.

While each book is intended for the final secondary level of its respective country, there are differences in the chapters covered. The difference in the chapters covered reflects a difference in syllabus for both countries. For a fair comparison, only similar chapters are compared in the analysis section of this dissertation. The chapters covered in both textbooks can be found in the following table, Table 3.1. The chapters directly compared in this dissertation are:

- Chapter 2 (Malaysian textbook) and Chapter 2 (Singaporean textbook)
- Chapter 7 (Malaysian textbook) and Chapter 6 (Singaporean textbook)

Malaysia	n textbook	Singaporean textbook		
Chapter	Торіс	Chapter	Торіс	
1	Number Bases	1	Graphical Solution of	
			Equations	
2	Graphs of Functions II	2	Further Graphs and	
			Graphs Applied to	
			Kinematics	
3	Transformations III	3	Vectors in Two	
			Dimensions	
4	Matrices	4	Standard Deviation and	
			Mean	
5	Variations	5	Cumulative Frequency	
			Distribution	
6	6 Gradient and Area Under		More on Probability	
	a Graph			
7	Probability II	7	Revision	
8	Bearing			
9	Earth as a Sphere			
10	Plans and Elevations			

Table 3.1: List of chapters found in Malaysian and Singaporean final secondary level Mathematics textbooks.

#### 3.1.2 Framework of Analysis for Metadiscourse Markers

An adaptation of Hyland's (2005) framework of metadiscourse is used (as found in Chapter 2, Section 2.3.1, Table 2.1) to examine metadiscourse. Because the textbooks used in the analysis are published in a country where English is not the first language, words are cross-checked with a dictionary to ensure the intended meaning is suitable with the metadiscourse marker categories, as per Hyland's (2005) and Hyland and Tse's (2004) suggestion. This dissertation aims to categorize the types of metadiscourse markers in both Malaysian and Singaporean textbooks to discover if they are similar or not. Every instance of metadiscourse marker found in both books are recorded and counted based on Hyland's (2005) framework, then a frequency count is done to project possible patterns in the usage of the metadiscourse markers. All of the categories suggested by Hyland (2005) are used in

this dissertation, in order to be able to best classify the metadiscourse markers found in the textbooks. Words considered for each metadiscourse category can be found in Appendix A.

# 3.1.3 Framework of Analysis for Interdiscursive Elements

The analysis of interdiscursive elements in this dissertation uses an adaptation of the framework established by Fairclough (2002). Just like the analysis of metadiscourse markers, words which signal interdiscursivity are identified and a frequency count is done to project possible patterns. In order to ensure the words are interdiscursive in nature, a dictionary is used to ensure the word belongs to the domain of another discourse, as per Sinclair's (2004) suggestion. Words are cross-checked with a dictionary to ensure the intended meaning is suitable with the type of discourse. Every instance of interdiscursivity found in both books are recorded and counted, and then a frequency count is done to project possible patterns in the usage of interdiscursivity.

The types of discourse found in the books are categorized into the following categories, based on dictionary definitions:

- i. Computer discourse characterized by the usage of terms and jargons related to computers and computing technology. Terms include CPU, mainframe, mouse,
   Microsoft Excel, and many more
- ii. Medical discourse characterized by the usage of terms used in the medical world, such as stethoscope, cardiograph, and thermometer.
- iii. Cultural discourse characterized by the usage of terms specific to the culture of Malaysia and Singapore. Terms may include angklung, gamelan and dragon dance.

- iv. Transportation discourse a wide ranging discourse characterized by reference to vehicles, transportation technology, measurements of speed and energy involving transportation, and many more.
- v. Military discourse refers to the usage of terms reflecting items, equipment, vehicles and even various practices used in the military such as tanks, sniper rifle and covert-ops
- vi. Sports discourse characterized by the usage of terms relating to various sports, including their respective names, equipment and attire.
- vii. Legal discourse characterized by the usage of technical jargon and terms only found in the context of law.
- viii. Board game discourse characterized by the usage of terms and jargon relating to components and objects used in board games such as chess, backgammon, snakes and ladders, etc. Components and objects include dice, coins, and tokens.

# 3.1.4 Framework of Analysis for Visual Semiotic Elements

The final part of the textual analysis relies on the visual semiotic composition system framework laid by Kress and van Leeuwen (1996). The graphic and textual elements are "boxed" as per the framework, and the elements of information value, salience and framing are noted. They are then compared with the textual elements in the textbook in order to elaborate their usage and composition.

#### **3.2** Survey Analysis Research Design

The second part of this dissertation research is a questionnaire survey analysis, meant to compliment the textual element analysis. This is following the suggestions of Hyland

(2005) and Hyland & Tse (2004), who found that an analysis of textual elements can only describe the situation best when complimented with a survey involving users of the text. The users of the two textbooks in question are Malaysian and Singaporean final secondary level students, as well as Malaysian high school mathematics teachers.

# 3.2.1 Instruments: Questionnaire Surveys and Procedures of Data Collection



Figure 3.3: Screenshot of the online questionnaire.

The survey used for this dissertation (seen in Figure 3.3) is in the form of an openended questionnaire. The primary advantage of using this method is that it allows the researcher to discover the attitudes and characteristics of the respondents (Babbie, 2008). However, there are disadvantages. Researcher bias may occur, as the opinions and feedback provided by respondents are subject to the researcher's interpretation. Survey items which may seem clear to the researcher may be unclear to the respondents, and some respondents may not be incompetent in answering – they might end up not answering the questions as expected, or even completely misunderstand the question presented. Also, due to the impersonal nature of the questionnaires (as it was done online), it is impossible to take note of the behavior and activities of the participants while they were filling up the questionnaire (Creswell, 2014). To overcome this, the language used in the questionnaire survey is not highly technical in nature, and extra care is taken in interpreting the feedback from the respondents.

Several issues were anticipated prior to data collection. It was expected that some students and teachers may be reluctant to participate, due to the knowledge that their feedback would be used for research. It was also expected that the respondents may feel pressured and uninterested while answering the questionnaire, due to the length of the questionnaire and the time needed to answer the questions. In order to counter this, as per Creswell's (2014) suggestion, the respondents are assured that they are given the freedom to choose if they want to complete the questionnaire, and that they may choose to cancel at any time. Also, no forms needed to be signed by the respondents.

The entire data collection for the questionnaire was conducted online, at the convenience of the respondents from 1<sup>st</sup> January 2015 until 1<sup>st</sup> May 2015. Google Forms was used to host the questionnaire online, which was viewable on any device that has internet access, including laptops, tablets and mobile phones.

Respondents were given a link to allow them to access the questionnaire. The survey meant for students is accessible at https://docs.google.com/forms/d/1Jatyk nTW6vIAiDMZav3FOxsaQorR0kCIAG157NdQ3

E/viewform, while the survey meant for teachers is accessible at https://docs.google.com/forms/d/1FAi1Z4G2t6lJ1weuu0hvjc7sOHwqzY\_0DIuIuJCd3Z0/vi ewform (refer to Appendix B for the questionnaire distributed to students and Appendix C for the questionnaire distributed to teachers).

Feedback provided by all 42 respondents were automatically recorded and tabulated by the app into an Excel spreadsheet, complete with timestamp to mark when each respondent had finished answering the questionnaire. Prior to receiving the link to the questionnaire, each respondent was briefly informed the purpose of this research. They were all assured that their answers would not be judged, as the main interest of this research is to examine the insights they could provide to this research, not whether their answers are right or wrong. They were also assured that all details would be kept strictly confidential and would only be used for the purpose of this research (refer to Appendix B & C for details of disclaimer briefed to each respondent).

In order to minimize any possible form of biasness, the respondents were solicited online using a snowballing sampling method. The main advantage of this method for this particular research is that it makes participants obtainable from states which are hard to be reached by the researcher. Regarding criteria of participant selection, for students, they must have just recently finished their final secondary level examinations. Meanwhile, for teachers, they must be high school mathematics teachers who teach mathematics at the final secondary level. The target number of respondents is at least 30 for the students and at least 5 for the teachers. The target number of respondents was exceeded.

Information regarding the survey was spread via social media (Facebook and Twitter) and people who knew possible respondents shared contacts for the researcher to provide links to the online questionnaires. This allows the respondents from various states that were otherwise harder to reach for the researcher to be sampled. A number of respondents were also obtained via friends and family members of acquaintances who knew students who have just finished their final secondary level examinations.

One of the problems faced at this stage was that it was hard for respondents to reach out to the researcher in case they had any questions, and it was hard for the researcher to reach out to the respondents should any clarification be needed, as no form of identification or tagging is requested from the participants. To counter this, the researcher's e-mail was provided in the questionnaire and respondents were informed that they may e-mail the researcher should there be any queries. However, no queries were received by the researcher.

The online questionnaire intended for Malaysian and Singaporean students is divided into three sections. Section A consists of basic questions on demographics (age, place of origin, location of school, etc). This is to gain an insight into the background of the students, as they may have an impact on their perception towards the mathematics textbooks from the two countries, as explored in Chapter 5.

Meanwhile, Section B consists of several pairs of scanned pages from the mathematics textbooks. Each pair consists of one scan from the Malaysian textbook and one scan from the Singaporean textbook. The scans come from chapters in both books which are concerned with the same topic in mathematics. Each pair is meant to represent the types of discourses and strategies found in both textbooks, and each pair is followed by a set of questions. Questions regarding the layout for each pair of scan are asked to correspond with the semiotic analysis of this research. Scans are chosen based on the metadiscourse and interdiscursive elements found in the two textbooks. The respondents

are not made aware of what exactly they are being tested on or what area of discourse is intended to be analyzed. The way the section is structured can be seen in Appendix B.

Meanwhile, high school mathematics teachers received a different questionnaire (refer to Appendix C). The questions are formulated based on the responses from the students in the previous questionnaire. The list of questions can be found in Appendix C.

There were a number of limitations and setbacks of the procedures of data collection that need to be acknowledged. As the questionnaires were conducted online, it was impossible to observe the how the respondents answered. Also, in sections where respondents were given the freedom to provide longer answers rather than a choice of provided answers, it is possible that the answers they have given were exaggerated or even downplayed. Having said that, the freedom to answer the questionnaire at their own convenience and the lack of an observer meant that there was less pressure on the respondents to answer the questions.

#### Chapter 4

### **Findings and Data Analysis**

#### 4.0 Introduction

This chapter aims to answer the first research question of this dissertation:

i. What are the textual similarities and differences between Malaysian mathematics textbooks in English and Singaporean mathematics textbooks at the final secondary level?

The primary purpose of this chapter is to establish the textual elements which make up the discourse in Malaysian and Singaporean final secondary level mathematics textbooks. The different textual elements of the textbooks examined in this paper are metadiscourse markers (Section 4.1), interdiscursivity (Section 4.2), and visual semiotic elements Section 4.3).

# 4.1 Metadiscourse Markers

This section intends to highlight the frequency of occurrences of metadiscourse markers found throughout both the Malaysian and Singaporean mathematics textbooks. The incorporation of metadiscourse markers is a strategy used by authors to engage with readers in order to make the content more interesting and interactive.

The following chart shows the kinds of metadiscourse markers used in the Malaysian and Singaporean mathematics textbooks, along with their frequency of occurrence throughout the textbooks:



Figure 4.1: Frequency of occurrence of metadiscourse markers found in Malaysian and Singaporean final secondary level mathematics textbooks

Figure 4.1 shows the frequency of occurrence of metadiscourse markers found in both Malaysian and Singaporean final secondary level mathematics textbooks. It must be noted that both books were published in their respective countries, and both were designed and written in a way which fulfills the policies and requirements of their respective ministries. Despite these variables, when comparing the percentage of metadiscourse markers in both textbooks, the values are very close. The similarity in the amount of metadiscourse markers found in both textbooks is of particular interest. Both books feature significantly different number of chapters and even different chapters, and yet the distribution of metadiscourse markers for both books is almost the same.

 Table 4.1: Total amount of metadiscourse markers found in Malaysian and Singaporean final secondary level

 Mathematics textbooks

Metadiscourse marker category		Frequency in Malaysian Textbook	Frequency in Singaporean Textbook	
Interactive	Transitions	171	147	
	Frame Markers	278	260	
	Endophoric	540	701	
	Markers			
	Evidentials	13	3	
	Code Glosses	23	32	
Interactional	Hedges	7	24	
	Boosters	6	14	
	Attitude Markers	8	11	
	Self-mentions	144	135	
	Engagement	1530	2016	
	Markers			
Total number of metadiscourse markers		2720	3343	
Total number of words in textbook		44240	55964	
Percentage of metadiscourse markers in		6.149%	5.973%	
textbook				

Table 4.1 shows the total amount of metadiscourse markers found in in both Malaysian and Singaporean final secondary level mathematics textbooks. The findings in Table 4.1 suggest that there may be a particular style expected when writing mathematics educational materials, and this may be a norm of how metadiscourse strategies are used in mathematics discourse, as far as Malaysia and Singapore textbooks are concerned. As seen in the frequency of endophoric markers in the Singaporean textbook in Table 4.1, the Singaporean textbook is keener on referring to information in other parts of the text. The excerpts below from the Malaysian and Singaporean textbooks clearly illustrate this. Note the type of metadiscourse markers found in each excerpt. Items in square brackets are metadiscourse markers from the book itself, while the category of discourse marker is mentioned in rounded brackets.

### Excerpt 4.1 – Malaysian textbook, p.2

[Let us revise] (engagement marker) the number in base ten that [we] (self-mention) use in daily life. Digits 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9 are used for numbers in base ten. In a number, every Excerpt 4.1 is an example of an introductory paragraph used in the Malaysian mathematics textbook. The textbook typically begins with a short paragraph that explains a brief background of the concept. Note the usage of metadiscourse markers. An engagement marker and self-mention is used so that the author makes his presence known and engages with the reader. A slightly different strategy can be found in the Singaporean textbook, as seen in the following excerpt:

# Excerpt 4.2 – Singaporean textbook, p.3

[In Book 2] (evidential marker), [we] (self-mention) learnt how to draw graphs of linear and quadratic functions. [Now] (transition marker), [we] (self-mention) will learn how to draw graphs of cubic, reciprocal and exponential functions. [Let's recall] (engagement marker) the steps for drawing a linear or quadratic graph.

The excerpt above is a typical introductory paragraph used in the Singaporean mathematics textbook. This paragraph is the very first paragraph of the first chapter of the Singaporean textbook, and early on, more than one metadiscourse markers are used to engage with the readers to create a context for the reader to understand. Note how even within one paragraph, there are many different metadiscourse markers which can be found. In many introductory and explanatory paragraphs throughout the book, self-mentions and engagement markers are commonly found. An example of this is shown in Excerpt 4.3:

Excerpt 4.3 – Singaporean textbook, p.9

[We] (self-mention) [shall now learn] (engagement marker) about the graph of the function  $y=a/x^2$ , [where a is a real number and a = 0] (endophoric marker). [The function  $y=a/x^2$ ] (endophoric marker) is defined for [all real values of x, except when x=0] (endophoric marker).

In Excerpt 4.3, endophoric markers are used to refer to formulae throughout the page. The usage of endophoric markers is more frequent in the explanatory paragraphs and they are used to explain answers to exercises, as seen in the following excerpt:

Excerpt 4.4 – Singaporean textbook, p.7

As [the positive value of x] (endophoric marker) increases, [the value of y] (endophoric marker) decreases. [The curve] (endophoric marker) gets very close to the x-axis but never touches it. As [the positive value of x] (endophoric marker) decreases, [the value of y] (endophoric marker) increases rapidly and it gets very close to the y-axis.

The excerpt above shows how endophoric markers are typically used when explaining mathematical equations. The explanations feature more than one endophoric marker in each sentence. Each of the endophoric markers used refer to text and graphics located throughout the page. In contrast, the following excerpt from the Malaysian textbook show how endophoric markers are used. Note the number of endophoric markers used in comparison to those found in the excerpt from the Singaporean book, which is much less frequent.

Excerpt 4.5 – Malaysian textbook, p. 35

[We] (self-mention) [know] (engagement marker) that [a graph of a linear function is a straight line]

(endophoric marker). To sketch [a graph of a linear function y = ax + b] (endophoric marker), where a = 0, [we] (self-mention) [must first determine] (engagement marker) the [y-intercept and x-intercept] (endophoric marker).

Excerpt 4.5 shows the type of metadiscourse markers used in explanations for mathematical equations in the Malaysian textbook. While endophoric markers are definitely used, their usage is not as frequent as in the Singaporean textbook. Instead, we find that self-mentions and engagement markers are more frequently used in the explanations. It is in the explanations where we find the author's voice in the textbook discourse through the usage of these metadiscourse markers. This is of particular note, as it appears that the way the Singaporean textbook uses engagement markers are markedly different from the Malaysian textbook. The Singaporean textbook uses engagement markers and self-mentions in the introductory paragraphs, while the Malaysian textbook uses them in the explanations for mathematical equations.

From the previously shown excerpts, a number of assumptions can be made. This difference in choice of preference of different metadiscourse strategies may reflect a difference in style when presenting different types of information. The Singaporean textbook appears keener on referring to information from other paragraphs in the same page, as well as other parts of the same textbook, presumably in order to help the reader better understand the questions and statements given.

When looking at the frequency of metadiscourse markers for every chapter, the findings appear to be different from what is found when looking at the overall frequency of metadiscourse markers in the textbook. It must be noted that both books have similar and different chapters. Therefore, for a fair comparison, only similar chapters are compared. Two pairs of chapters are compared:

- Chapter 2 from the Malaysian textbook (Graphs of Functions II) with Chapter 2 from the Singaporean textbook (Further Graphs and Graphs Applies to Kinematics)
- Chapter 7 from the Malaysian textbook (Probability II) with Chapter 6 from the Singaporean textbook (More on Probability).

# 4.1.1 Comparison between Chapter 2 from both Malaysian and Singaporean Final Secondary Level Mathematics Textbooks

The first pair of chapters which are directly comparable in both textbooks is Chapter 2 from both books. The topic covered is 'Further Graphs' (the Malaysian textbook uses a slightly different name, but it is still the same topic). When looking at the frequency of occurrence of metadiscourse markers in both chapters, some differences can be observed as shown in the following table, Table 4.2:

 Table 4.2: Metadiscourse markers found in Chapter 2 of both Malaysian and Singaporean final secondary

 level mathematics textbooks

Metadiscourse marker category		Frequency in Malaysian Textbook	Frequency in Singaporean Textbook	
Interactive	Transitions	20	15	
	Frame Markers	22	18	
	Endophoric	100	68	
	Markers			
	Evidentials	2	0	
	Code Glosses	2	0	
Interactional	Hedges	3	4	
	Boosters	4	1	
	Attitude Markers	1	0	
	Self Mentions	25	11	
	Engagement	208	157	
	Markers			
Total number of metadiscourse markers		287	274	

Total number of words in chapter	2549	5615
Percentage of metadiscourse markers in	11.259%	4.880%
chapter		

Several observations can be made based on Table 4.2. The Malaysian textbook uses all types of metadiscourse markers throughout Chapter 2, while the Singaporean textbook does not use evidentials, code glosses and attitude markers in this chapter. As seen in Table 4.2, The Malaysian textbook also has a higher percentage of metadiscourse markers in this chapter (11.259%) compared to the Singaporean textbook (4.880%). This could perhaps be due to the different writing styles and approaches in both books.

The following excerpt illustrates the way endophoric markers and engagement markers are used in the chapter of the Malaysian textbook:

# Excerpt 4.6 – Malaysian Textbook, p. 31

[The following graph shows y = 3 + 2x - x2] (endophoric marker). [From the graph] (endophoric marker), [find] (engagement marker) the value of y.

Excerpt 4.6 is a typical instruction found in Chapter 2 from the Malaysian textbook. Instructions like the one found above are frequently repeated throughout the chapter. An example of an instruction used in the Singaporean textbook can be seen in the following excerpt.

# Excerpt 4.7 – Singaporean Textbook, p. 49

[Draw] (engagement marker) a graph of [these values] (endophoric marker), using a scale of 2 cm for 2 minutes on [the horizontal axis] (endophoric marker) and a scale of 2 cm for 2 km on [the vertical

Excerpt 4.7 shows a typical instruction found in Chapter 2 from the Singaporean textbook. While it uses one less endophoric marker compared to the example from the Malaysian textbook, both textbooks are seen to use more or less the same format – engagement markers to start off questions, with endophoric markers to refer to a part of the text on that page which the instructions are referring to.

Despite using similar strategies in instructions, Chapter 2 from the Singaporean textbook features fewer instructions and instead features more explanations. Mathematical instructions appear to rely on endophoric markers and engagement markers. When comparing only the instructions, the structure and way the metadiscourse markers are expressed are no different, as seen from both Excerpt 4.6 and Excerpt 4.7. Meanwhile, the following excerpt shows the kind of metadiscourse markers which are used in explanations in Chapter 2 of the Malaysian textbook.

# Excerpt 4.8 – Malaysian Textbook, p. 35

Sketching a graph means drawing [a graph] (endophoric marker) without the actual data. [It] (endophoric marker) helps [us] (engagement marker) to visualize [the relationship of the variables] (endophoric marker). When [we] (self-mention) [sketch the graph] (engagement marker), [we] (self-mention) [do not use] (engagement marker) a graph paper, [however] (attitude marker) [we] (self-mention) [must] (booster) [know] (engagement marker) the important characteristics of the graph such as its general form (shape), the y-intercept and the x-intercept.

Excerpt 4.8 shows an example of an introduction found in the second chapter of the Malaysian textbook. Instructions like Excerpt 4.8 are used when explaining sub-topics within the chapter. The explanatory paragraph is seen to use different types of metadiscourse markers. Endophoric markers are used to refer to content and images within the same page, while engagement markers are used by the authors to further justify the points introduced using the endophoric markers. The paragraph above also features the chapter's only usage of an attitude marker (however), a booster (must) and several selfmentions, which all function to create a more interactive and engaging interaction with readers. Hyland (2005) highlighted that the usage of many different metadiscourse markers help create a much more engaging experience for readers, which helps them understand the content better. When explaining exercises however, the Malaysian textbook uses a slightly different strategy, as seen in the next excerpt.

# Excerpt 4.9 – Malaysian Textbook, p. 43

A graph is [a drawing] (endophoric marker) which shows the relationship between members or quantities. [We] (self-mention) [can use] (engagement marker) [graph] (endophoric marker) to solve problems.

When explaining questions and answers throughout the chapter, the Malaysian textbook uses shorter sentences with less metadiscourse markers compared to the strategy used when explaining sub-topics within the chapter. Throughout the chapter, this format is used when explaining questions and answers, with the endophoric marker being the most used metadiscourse marker to do this. The Singaporean textbook's approach in the

explanations used in Chapter 2 is similar, with a few differences in comparison to the Malaysian textbook. The following is an excerpt from the Singaporean textbook.

# Excerpt 4.9 – Singaporean Textbook, p. 41

[We] (self-mention) have studied [various forms of graphs] (endophoric marker) and their applications to problems. [We] (self-mention) [shall now look] (engagement marker) at [some simple graphs] (endophoric marker) as applied to kinematic problems involving distance-time and speed-time. A cyclist starts a 50-km journey at 08:00. [The table below] (endophoric marker) is the distancetime chart of his journey.

In Excerpt 4.9, an example of an introduction to a sub-topic found in the Singaporean textbook's second chapter can be seen. When compared to the Malaysian textbook, the strategies are indeed similar. The same types of metadiscourse markers can be found, with the exception of attitude markers and boosters, which are only used in the Malaysian textbook. Differences are more noticeable when looking at explanations for questions and answers throughout the chapter, as observed in the next excerpt.

# Excerpt 4.10 – Singaporean Textbook, p. 48

[We] (self-mention) [shall now study] (engagement marker) the applications of the gradients of tangents in kinematics.

When the distance-time graph is a straight line, the gradient measured is of that between [any two points on the line] <sub>(endophoric marker)</sub>. When the distance-time graph is a curve, [the gradient at the point P] <sub>(endophoric marker)</sub> is defined as the gradient of the tangent to the [curve at the point P] <sub>(endophoric marker)</sub>.

[The gradient of the tangent at a point on a distance-time graph] (endophoric marker) gives the speed at [the particular point] (endophoric marker). [It] (endophoric marker) is also called the instantaneous speed.

Explanations to questions and answers in Chapter 2 are structured like the example found in Excerpt 4.10. This usage of self-mentions at the beginning of the excerpt could mean that the authors prefer to include the readers in every part of the explanation whenever possible. This is particularly interesting, because in a subject as complex as mathematics, explanations are crucial in making the audience understand the message. Having the authors being more "involved" in the process should theoretically help the readers more.

Meanwhile, the following table shows the frequency of metadiscourse markers in Chapter 7 of the Malaysian textbook and Chapter 6 from the Singaporean textbook.

# 4.1.2 Comparison between Chapter 7 of Malaysian Textbook and Chapter 6 of Singaporean Textbook

For the next pair of chapters which will be compared in this analysis, Chapter 7 of the Malaysian textbook and Chapter 6 of the Singaporean textbook were chosen. While there are a few similarities, unlike the previous pair of chapters previously compared, the findings for these two chapters show some differences.

Table 4.3: Metadiscourse markers found in Chapter 7 from the Malaysian textbook and Chapter 6 from the

Metadiscourse marker category		Frequency in Malaysian Textbook	Frequency in Singaporean Textbook	
Interactive	Transitions	12	11	
	Frame Markers	15	37	
	Endophoric	10	52	
	Markers			
	Evidentials	0	0	
	Code Glosses	1	2	
Interactional	Hedges	1	3	
	Boosters	0	0	
	Attitude Markers	0	0	
	Self Mentions	15	34	
	Engagement	98	220	
	Markers			
Total number of metadiscourse markers		152	359	
Total number of words in chapter		3589	8450	
Percentage of metac	liscourse markers in	4.235%	4.249%	
chapter				

Singaporean textbook

As can be seen from Table 4.3, both chapters from both textbooks do not use any evidentials, boosters or attitude markers at all. This is perhaps the characteristic of the writing style for this particular topic on probability. The clearest difference is in the number of engagement markers used. The Singaporean textbook uses far more engagement markers than the Malaysian textbook. Other markers which are used way more than the Malaysian textbook are frame markers and endophoric markers. Compared to the previous comparison of chapters of both textbooks, different sections within the chapter appear to have their own distinct strategy of metadiscourse marker usage. The following excerpt is an example of an introductory text in Chapter 7 of the Malaysian textbook.

# Excerpt 4.11 – Malaysian textbook, p. 213

Probability is another way of looking at the likelihood of an event. It compares the number ways an event can happen to the total number of possible outcomes [The following diagrams] (endophoric marker) show two spinners. [Spinner A] (endophoric marker) has four sectors of the same size while [spinner B] (endophoric marker) has four sectors of different sizes.

For [spinner A] (endophoric marker), the probability of getting colors red, blue, green and yellow is the same. [But] (transition) for [Spinner B] (endophoric marker), the probability is different from the others. [Why] (engagement marker) is this so?

In Excerpt 4.11, the strategy at first appears to be similar to that from the previous chapter from the Malaysian textbook. Endophoric markers are used throughout the excerpt. The usage of endophoric markers allows the author to highlight each process and procedure that occurs step by step.

# Excerpt 4.12 – Singaporean textbook, p. 208

As a promotional activity, each shopper in a particular shopping center is given two golf balls. A shopper will win a prize if he/she gets a ball into one of the holes. A grand prize is given if a shopper gets both balls into the holes. [What] (engagement marker) is the probability that this little girl and her mum will win a grand prize? [We] (self-mention) shall study some simple techniques to find the probability of an event happening [in this chapter] (endophoric marker).

Meanwhile, Excerpt 4.12 is an introductory paragraph from Chapter 6 from the Singaporean textbook. Once again, it is quite similar to the introductory paragraph found in the earlier chapter of the Singaporean textbook. The only noticeable difference is that the Singaporean textbook is keener on using self-mentions for its introductory paragraphs.

[We] (self-mention) [have learnt] (engagement marker) that equiprobable sample space means a sample space where each event is equally likely to happen. The condition to get equally likely outcomes is by choosing randomly. Let [us] (self-mention) [determine] (engagement marker) the probability of an event with equiprobable sample space.

Excerpt 4.13 is a sample of an explanatory paragraph found in Chapter 7 of the Malaysian textbook. There appears to be two different styles used for explanations in this chapter. The excerpt above shows the first style found, which is very similar to that found in Chapter 2 of the same book in its usage of self-mentions and engagement markers. Meanwhile, the next excerpt shows the second style of explanatory paragraph used in the Malaysian textbook.

Excerpt 4.14 – Malaysian textbook, p. 216

[In our daily life] (frame marker), [we] (self-mention) often encounter with more than one outcome. The type of car to buy, to attend or not attend a function, to eat outside or to cook at home are some examples. [Our knowledge] (self-mention) on probability [can help us solve] (engagement marker) these problems sensibly.

Excerpt 4.14 shows the second style of explanatory paragraph used in the Malaysian textbook for this chapter. This style of explanatory paragraph is distinguished by the usage of frame markers at the beginning. The Malaysian textbook alternates between these two styles throughout the chapter. The first style is used for more general explanations, while the second style is often used when relating the explanations to the

concepts learned in the chapter. The Singaporean textbook also employs a similar strategy of using two different styles, as seen in the following excerpts.

# Excerpt 4.15 – Singaporean textbook, p. 212

[In Book 2] (endophoric marker), [we] (self-mention) [learnt] (engagement marker) that listing all possible outcomes of an experiment in the same sample space is a useful tool for solving problems in probabilities; [we] (self-mention) [shall have] (engagement marker) a quick revision before looking at possibility or probability [diagrams and tree diagrams] (endophoric marker).

The excerpt above is an example of an explanatory paragraph used in Chapter 6 of the Singaporean textbook. When compared to the explanatory paragraph from Chapter 2 of the same book, they are indeed similar, in its usage of self-mentions, engagement markers and endophoric markers. This is the first style of explanatory paragraph used in this chapter. The next style of explanatory paragraph used in this chapter is seen in the next excerpt.

# Excerpt 4.16 – Singaporean textbook, p. 224

[Let's trace] (engagement marker) the path made to obtain the outcome (H, H) from left to right. [For the first coin] (frame marker), there are two possible outcomes, H or T. [We] (engagement marker) shall trace the path that goes upwards. [For the second coin] (frame marker), H from the [first coin] (endophoric marker) branches out into H or T. [Once more] (frame marker), [we] (self-mentions) [trace] (engagement marker) [the path that goes upwards] (endophoric marker) to reach the outcome (H, H). The second style of explanatory paragraph used in this Chapter 6 of the Singaporean textbook can be seen in Excerpt 4.16. Similar to the second style of explanatory paragraph used in the Malaysian textbook, the Singaporean counterpart is also defined by its usage of frame markers. However, what makes the Singaporean textbook very different in this chapter is that frame markers occur more often. In the Malaysian textbook, frame markers are used to begin an explanatory paragraph of this style, while in the Singaporean textbook, they are used more than once.

# Excerpt 4.17 – Malaysian textbook, p. 223 📛

A fair coin is tossed and a marble is picked at random from a bag containing a yellow, a blue and a red marble. [The marbles] <sub>(endophoric marker)</sub> are identical in size and material. a) [What] <sub>(engagement marker)</sub> is the probability of getting a 'Heads' and a yellow marble? b) [What] <sub>(engagement marker)</sub> is the probability of getting a 'Tails' and a yellow or red marble? c) [What] <sub>(engagement marker)</sub> is the probability of getting a 'Heads' or 'Tails' and a blue marble?

Meanwhile, exercises in this chapter have their own distinctive metadiscourse strategy compared to the rest of the chapter for both Malaysian and Singaporean textbooks. Excerpt 4.17 shows an example of an exercise which can be found in Chapter 7 of the Malaysian textbook. Usage of engagement markers is frequent, and every question uses it. Other categories of metadiscourse markers are seldom found. Excerpt 4.17 is an exception, seeing the usage of an endophoric marker

Excerpt 4.18 – Malaysian textbook, p. 217

1. The studies by the Meteorological Department found that the probability of rain in Town A on any given day is 2/5. [Can you find] <sub>(engagement marker)</sub> how many days in a year Town A will have rain? (1 year = 365 days)

2. In Form 5 Alpha, 12 students come to school by bus. If a student is picked at random from [the class] <sub>(endophoric marker)</sub>, the probability of picking a student who comes to school by bus is 3/5. [Calculate] <sub>(engagement marker)</sub> the total number of students in the class.

Excerpt 4.18 is another example of an exercise from the Malaysian textbook for this chapter. As can be seen from the excerpt, engagement markers are the only metadiscourse markers used throughout the exercises in this chapter with a few exceptions such as the example found in Excerpt 4.17. The Singaporean textbook adopts a very different strategy, as seen in the next excerpt.

# Excerpt 4.19 – Singaporean textbook, p. 218

- a) [What] (engagement marker) is the probability that the [first spinner] (endophoric marker) shows the larger number? [Did you get] (engagement marker) 3/8?
- b) [What] (engagement marker) is the probability that
- (i) [both spinners] (endophoric marker) show even numbers;
- (ii) [both spinners] (endophoric marker) show odd numbers;
- (iii) [spinner 1] (endophoric marker) shows even number but spinner 2 shows odd number;
- (iv) [spinner 1] (endophoric marker) shows odd number but spinner 2 shows even number?

Excerpt 4.19 is a sample of an exercise found in Chapter 6 of the Singaporean textbook. This is one of two styles used throughout this chapter. This first style sees heavy

usage of endophoric markers, which is more than any other metadiscouse marker within the same question or paragraph. This is primarily to refer to aforementioned concepts or objects previously mentioned in either the same question or even previous questions. The second style is seen in the next excerpt.

#### Excerpt 4.20 – Singaporean textbook, p. 232

[Let's do] (engagement marker) the previous activity again, but this time, after picking [the first ball] (endophoric marker) randomly, [do not replace] (engagement marker) the ball before picking [the second ball] (endophoric marker).

[Record] (engagement marker) 20 sets of results for this process of picking two balls without replacement. [Is] (engagement marker) the probability that both balls are red different from that in [the previous experiment] (endophoric marker)?

The second style of exercises found in this chapter of the Singaporean textbook can be seen in Excerpt 4.20. What really defines the exercises in both Chapter 2 and Chapter 6 of the Singaporean textbook is the usage of endophoric markers & engagement markers.

#### 4.2 Interdiscursive Elements

This section intends to highlight the frequency of occurrences of interdiscursivity found in both the Malaysian and Singaporean mathematics textbooks. The incorporation of other discourses via interdiscursivity into to the main textbook discourse is a strategy is used by authors to relate the subject matter to other topics and to help readers better understand the subject. As mathematics is a dense subject for students to understand, the usage of interdiscursive elements help students relate mathematical discourse with other discourses, showing the usefulness of mathematics in different fields.

The following tables, Table 4.4 and Table 4.5 show the occurrences of different kinds of discourses in both the Malaysian and Singaporean mathematics textbooks:

Chapter	Discourse category and frequency (number of sentences)						
-	Computer discourse	Transportation Discourse	Cultural discourse	Board game discourse	Business discourse	Electronics discourse	
1	-	-	-	-	-	-	
2	19	-	-	-	-	-	
3	12	-	-	-	-	-	
4	-	-	-	-	7	1	
5	-	-	-	-	-	-	
6	-	8	-		-	2	
7	2	-	-	3	-	-	
8	-	4	-	-	-	-	
9	-	12	-	-	-	-	
10	-	-	-	-	-	-	

 Table 4.4: Occurrences of interdiscursivity in Malaysian Mathematics Form 5 textbook

 Table 4.5: Occurrences of interdiscursivity in Singaporean Mathematics Secondary 4 textbook

Chapter	Discourse category and frequency (number of sentences)							
	Computer discourse	Transportation discourse	Cultural discourse	Board game discourse	Medical discourse	Military discourse	Sports discourse	Legal discourse
1	5	-	6	-	2	-	-	-
2	-	29		-		2	-	-
3	-	1	-	-	-	-	-	-
4	-		-	-	-	-	3	-
5	-	3	4	-	-	-	-	8
6	-	-	1	64	-	-	3	-
7	-	29	12	-	2	-	-	-

The Singaporean book has more categories of discourses (eight distinct categories) compared to the Malaysian textbook (six distinct categories). The Singaporean textbook is also keener on incorporating other discourses. The two books however, do share several categories of discourses, which are computer discourse, transportation discourse and board game discourse. The remaining discourses are exclusive to each textbook. These differences suggest that the ministry and education system of both countries relate mathematical concepts to different contexts.

# 4.2.1 Computer Discourse in Chapter 2 from Malaysian Textbook and Chapter 1 from Singaporean Textbook

Both textbooks were found to incorporate computer discourse into the main discourse of the textbook, particularly in chapters related to graphs. As such, this part of the analysis will focus on this discourse in the graph-related chapters from both textbooks, which are Chapter 2 from the Malaysian textbook and Chapter 1 from the Singaporean textbook. While both textbooks were found to incorporate computer discourse, both books did so differently, as seen in the following excerpts.

# Excerpt 4.21 – Malaysian textbook, p. 58

Example: A company has a cost function of  $C(x) = 2x^2 + 5x + 150$  and a revenue function of R9x) =  $-x^2 + 57x$ . Generate a table of values for 0 < x < 30

- 1. Use MSExcel to generate the values.
- 2. Enter headings in columns A(x), B(Revenue), C(Cost).
- a) Enter 0 in A2 and 1 in A3.
- b) Highlight A2 and A3.
- c) Move the cursor to the bottom right until a plus sign appears.
- d) Hold down the left button and drag the mouse down until the value 30 appears.

Excerpt 4.21 shows how computer discourse is incorporated in Chapter 2 of the Malaysian textbook. Excerpt 4.22 shows the kind of computer discourse found in the Singaporean textbook.

Excerpt 4.22 – Singaporean textbook, p.52
Step 1:	Open Graphmatica
Step 2:	Go to Options, Graph Paper to select Rectangular. Go to View to select
Grid Range.	
	Select range from -3 to 10
Step 3:	For the curve $y = 15 + 4x - 2x2$ ,
	Type $y = 15 + 4x - 2x2$ and press Enter to see the graph.
	How many points does the graph cut the x-axis?
	What are the solutions of the equation $15 + 4x - 2x^2 = 0$

An example of how computer discourse is incorporated in the Singaporean textbook can be seen in the excerpt above. Particularly interesting is that the authors or publishers of the book chose to put some of the words related to computer discourse in bold. This gives the terms extra emphasis and highlights that they are different from the rest of the discourse of the textbook.

# 4.2.2 Transportation Discourse in Malaysian and Singaporean Textbooks

Unlike computer discourse, both Malaysian and Singaporean textbooks incorporate transportation discourse in several chapters. As such, this part of the analysis will look at the chapters in which their incorporation is prominent. In the Malaysian textbook, transportation discourse is found in Chapter 6 (Gradient and Area under a Graph), Chapter 8 (Bearing) and Chapter 9 (Earth as a Sphere). The following excerpt shows the kind of transportation discourse found in Chapter 6 of the Malaysian textbook.

Excerpt 4.23 – Malaysian textbook, p. 191

We can use a graph to show the journey taken by a motorist. A motorist starts a 100km journey at 0800 hour. At 0900 hour, his motorcycle punctures and he spends half an hour repairing it. He then continues his journey and reaches his destination at 1030 hour. A graph of his journey is shown. From the first section of the graph, we can see that the motorist covers a distance of 40km in an hour (0800-0900). The horizontal section of the graph (0900-0930) indicates that he stops for half an hour to repair his motorcycle. The third section of the graph is steeper than the first section because the motorist covers 60km for the last hour.

Excerpt 4.23 is an example of an explanation paragraph in the chapter of the Malaysian textbook which features transportation discourse. Transportation-specific terms are not often found in explanations in this chapter, but in this excerpt, the term "punctures" is found within the text.

### Excerpt 4.24 – Malaysian textbook, p. 278

A ship in the Atlantic Ocean is in the position latitude 40'N, longitude 65'W. It sails along the parallel of latitude to a point which has longitude 22'W. Calculate the distance it has sailed. It then sails due south for 400 nautical miles. Calculate its new latitude. Find the total time taken if the ship has a constant speed of 450 knots throughout the journey.

Meanwhile, excerpt 4.24 shows the usage of transportation discourse in questions found in this chapter. The question features many transportation-specific terms, such as knots and nautical miles. The incorporation of these terms change the feel of the sentences, as it guides the reader into understanding the form of transportation mentioned in this excerpt. The Singaporean textbook employs similar strategies, as seen in the following excerpts.

# Excerpt 4.25 – Singaporean textbook, p. 70

Car A travelling at a steady speed of 10 metres per second passes a stationary car, B. Two seconds later, car B starts to accelerate uniformly for 6 seconds (that is, its speed increases at a uniform rate during the interval of 6 seconds) and reaches a speed of 15 metres per second. It then continues with this speed until it overtakes car A.

The excerpt above, Excerpt 4.25, is an example of an explanation paragraph in the Singaporean textbook. Similar to the Malaysian textbook, usage of transportation discourse in each paragraph is quite minimal. Transportation-related terms found here include "accelerate" and "overtakes".

# Excerpt 4.26 – Singaporean textbook, p. 68

A motorist, travelling at a constant speed, leaves A at 11 00, intending to arrive at B, 100 km away, at 13 00. Half an hour later, one of the tyres of his vehicle has a puncture and the motorist is delayed for 18 minutes. How fast must he then proceed in order to reach B on time? At what time will he meet a cyclist who leaves B at 11 45 for A, travelling at a constant speed of 20 km/h? Illustrate your answer by using a distance-time graph.

The next excerpt, Excerpt 4.26, shows some similarity with Excerpt 4.23. "Puncture" appears to be a commonly used transportation-related term used in both Malaysian and Singaporean textbooks. Regarding transportation, the Singaporean book seems more focused on cars, motorcycles and bicycles while the Malaysian book includes ships. The excerpt above features both cars and bicycles.

# 4.2.3 Boardgame Discourse in Chapter 7 from Malaysian Textbook and Chapter 6

#### from Singaporean Textbook

The last type of discourse found in both Malaysian and Singaporean textbooks is boardgame discourse. This type of discourse is found in the chapter pertaining to the mathematical concept of probability in both Malaysian and Singaporean textbooks. This type of discourse is incorporated very minimally in the Malaysian textbook, as seen in the following excerpt.

# Excerpt 4.27 – Malaysian textbook, p. 214

Jasmin rolled a fair dice. List the sample space.

Excerpt 4.27 shows one of the few instances featuring boardgame discourse. The term "fair dice", which is a term unique to boardgame discourse, is found in this chapter. This is the only term related to boardgame discourse that is repeated only several times throughout the entire chapter. The Singaporean book, however, features more boardgame discourse terms, as seen in the following excerpts.

### Excerpt 4.28 – Singaporean textbook, p. 209

A playing card is drawn at random from a standard pack of 52 playing cards. Find the probability of drawing

a) the king of hearts,

b) a red card

- c) a black queen
- d) an ace

Excerpt 4.28 is an example of a question from the Singaporean textbook which features boardgame discourse. A number of boardgame discourse terms can be found here. The terms include "standard pack", "playing card", "king of hearts", "black queen" and "ace". The Singaporean textbook appears to be very descriptive with this category of discourse and appears to incorporate as many terms possible from this discourse. Another example can be seen in the next excerpt.

### Excerpt 4.29 – Singaporean textbook, p 214

A fair coin and a fair dice are thrown at the same time. List the sample space of the event S. Find the probability of obtaining

a) a head and a prime number,

b) a tail and a number that is divisible by 3

Excerpt 4.29 shows how the Singaporean textbook incorporates many board game discourse terms within the one question. More terms are found here, such as "fair coin", "fair dice", "head" and "tails". This is a contrast to the Malaysian textbook, which uses board game discourse terms very minimally. The Singaporean textbook appears keener to include as many terms as possible, in order to expose readers to the discourse.

#### 4.3 Visual Semiotic Elements

This section intends to highlight the visual semiotic elements found in both the Malaysian and Singaporean mathematics textbooks. A subject as abstract as mathematics requires appropriate composition to help deliver the meanings effectively to the intended audience. The layout of the book as well as the organization and arrangement of texts are analyzed according to visual semiotic notions of composition as highlighted by Kress and van Leeuwen (1996).

Both the Malaysian and Singaporean textbooks are found to follow their own style of arrangement of texts. The two textbooks also have elements which are consistently used throughout each respective textbook. The Malaysian textbook is completely monochromatic, while the Singaporean textbook features a lot of color. However, the format and layout used by both textbooks are different. The following images highlight some visual semiotic observations of the pages of the Malaysian textbook. Figure 4.1: First page of a chapter in the Malaysian textbook



Figure 4.1 shows an example of the first page used for a chapter in the Malaysian textbook. Every first page of each chapter of the Malaysian textbook follows the layout structure seen in this image. It features a title at the top, a sidebar on the left, a panel at the bottom, and a graphic on the right. Based on Kress and van Leeuwen's (1996) framework of composition meaning, involving the notions of given, new, ideal, and real, the layout found on this page is a typical composition arrangement. The information at the top, which is "ideal", is meant to provide generalized information. In this case, the generalized information which is used throughout the chapter is the topic covered in this chapter. The bar at the bottom does indeed feature text which delves into details which are explored throughout the chapter. Looking at the notion of given (left) and new (right), the

arrangement of texts also confirm to what they have highlighted. Information arranged on the left of a page is meant for "given information", i.e. preconceived notions or facts, and this is exactly what the sidebar contains. Information arranged on the right of the page is meant to present "new" information. The graphic featured implies the kind of mathematical knowledge which students will obtain, thus fulfilling the role of "new".

While the first page of each chapter follows a very systematic, "arranged" approach, the contents of the Malaysian textbook follows a very different order, as seen in the following images. Figure 4.2: Sample of explanation page from Malaysian textbook

Let us revise are used to 1	the m	imber in unbers i	n base 1 n base	EAS ten that ten. In	we use	in daily	life. Di	gits 0, is a pla	FIVE 1, 2, 3, 4 ce value.	, 5, 6, 7	8 and	9
Example,												
	36,,,	$= 30_{10}$ = (3 × = (3 ×	$+ 6_{10}$ 10) + 10 <sup>4</sup> ) +	(6 × 1) - (6 × 1	(10)							
	4	This de	enoise th	a namber	is writter	in base I	-		8	No	tor	
	00.98		thousar thousar 0 <sup>2</sup> 1	10  five fin 10 +  fin 7able f. $0^2 = 1$ 5	re bundred f 0' 1 9 1	ed + n	inety eign	n eight	e which	means file ceith: 1073	pers.	
Table 1.1 sho place value	es that of 10° a	t digit 6 und digi	has a p t 8 has	slace va a place	lue of 1 value o	0 <sup>3</sup> , digi £ 10 <sup>4</sup> ,	t 5 has a	mber	value of	10 <sup>±</sup> , dig	a 9 has	
Table 1.1 sho place value v 1.1.A Lasenson of By the en number i	Stat In B Ancow d of the	t digit 6 und digit ing Ze ase Tw is subur two, ch	bas a p t 8 bas ro, On ro, Eig nat, you ght and	slace va a place o, Two jht and i will be i five.	due of 1 value o a, Thre d Five	0°, digi £ 10°, 63 8	t 5 hus a <b>s a Nu</b> erro, cone	n place mber	hrot,	10 <sup>±</sup> , dig	19has	
Table 1.3 sho place value i 1.1.A Leansing ( By the er number in 1 is the large Table 1 for	station of the second s	t digit 6 and digit ing Ze ase Tw is subor tero, et e two wo are it it is base	bas a p t 8 has ro, On ro, Eig rot, you ght and unbers e two.	shee va a place or, Two pht and a will be 5 five.	lue of 1 value o a, Three d Five a able to are write and there a	0 <sup>2</sup> , digi f 10 <sup>6</sup> , c and a state z then only	s by usin	n place mber , two, l	hreet,	10 <sup>2</sup> , dig	a 9 has	
Table 1.3 sho place value ( 1.1A Learnene 1 By the er number i A. Number Numbers in 1 is the largy Table 1.2 itus	es that of 10° a <b>Stati in B</b> a Curreow di of th in base base tv art digi nales so	t digit 6 and digit ing Ze ase Tw its subar two, et wo are n t in base me numb	has a p t 8 has ro, On ro, Eig nat, you ght and umbers c two. ers in be	shace va a place or, Two phi and o will be o will be o which so which	luc of 1 value of a, Three d Five e able to are write red bet o fable 1.2	0°, digi f 10°. <b>6 a</b> i state z tten otil	s a Nu s a Nu erro, cone s by usin s in base t	n <b>ber</b> , two. I ng digit zn.	hree,	10 <sup>2</sup> , dig	a 9 has	
Table 1.1 sho place value v 1.1 A Learnsine ( By the es number i A. Numbers in 1 is the large Table 1.2 itust Base ten	es that of 10° a Statt in B. Curreav d of th in base base tv at digi rules so 0	t digit 6 and digit ing Ze ase Two its subor tas subor tas tas subor tas subor tas subor tas sub	has a p t 8 has ro, On ro, Eig nit, you ght and unbers e two. ers in be	shace va a place or, Two pht and i will be 5 five. s which me two a 3	And the set of a set	0 <sup>4</sup> , digi f 10 <sup>4</sup> . e <b>5 8</b> e statu z quivalent 5	s by using a in base to 6	n place mber , two, i , two, i	hrest,	10 <sup>2</sup> , dig as a	n y has	

Figure 4.2 shows a sample of how mathematical information is explained in the Malaysian textbook. Note how every possible space in the page is filled with texts, graphics and boxes. While the page appears cluttered, the content is organized in a linear fashion, using a top-bottom approach. The notion of ideal and real are used here in the usage of titles, with the titles being the "ideal" elements for each content presented (which acts as the "real" element"). This arrangement is akin to the Vertical Triptych as proposed by Kress & van Leeuwen (1996).

Figure 4.3: Sample of exercises found in the Malaysian textbook.



When it comes to exercises, it becomes more difficult to make sense of the layout. As seen in the exercise at the top, the first question goes from left to right, similar to that of the Horizontal Triptych structure proposed by Kress & van Leeuwen (1996). However, the remaining questions follow a top-bottom approach. It is possible that this is done due to space constraints. However, such inconsistency in arrangement is found throughout the Malaysian textbook, especially in the exercises. Placement of elements is supposed to give value (Kress & van Leeuwen, 1996). However questions and explanations appear to be randomly placed throughout the pages of the Malaysian textbook. The contents do not appear to attract readers through contrast, and the way information is framed appears to be disconnected.



Figure 4.4: Final page of a chapter in the Malaysian textbook

One feature that is only found in the Malaysian textbook and is absent from the Singaporean textbook is a final page for each chapter to summarize what has been learnt. For this final page, the summary is listed in a hierarchical chart in a linear fashion to show the flow of the topics learnt. The Singaporean textbook does not have such a page. There is no summary for chapters in the Singaporean textbook.



Figure 4.5: First pages of a chapter in the Singaporean textbook

Meanwhile, the Singaporean book has a different layout style compared to the Malaysian textbook. The "first page" for each chapter is spead across two pages. While the content is spread across two pages, there are two separate elements working together at the same time. The text acts as a foregrounded element, while the graphics are in the background. The text is arranged using a top-bottom approach, with the titles at the top and the text following the title. Every pair of first pages for each chapter in the Singaporean textbook features a different graphic on the left side, each representing what will be learned in the chapter. This graphic is treated as "given", in contrast to the Malaysian textbook which treats the graphic as "new".

Figure 4.6: Sample of explanation page in Singaporean textbook

![](_page_84_Figure_1.jpeg)

Figure 4.6 shows an example of explanations found in the Singaporean textbook. The text is arranged in a linear arrangement, using a top-bottom approach. The graphic elements are normally bigger than the textual elements, in order to give emphasis to the graphics.

**Figure 4.7:** Sample page from Singaporean textbook

Observe the armh of $y = \frac{1}{2}$ , we notice that:	
<ol> <li>Although the graph occurs in two separate parts, it must be regarded a two separate graphs.</li> </ol>	to a single graph and not as
(2) As the positive value of x increases, the value of y decreases. The cur axis but never touches it. As the positive value of x decreases, the valu it gets very close to the y-axis.	we gets very close to the a- e of y increases rapidly and
When x is negative, y becomes larger as x becomes smaller and why decreases rapidly. In other words, as x approaches zero, y approach	nen x gets very close to 0, es infinity (symbol; =),
(3) When $x = 0$ , the function $y = \frac{1}{x}$ is not defined. This means that there	is a break when $s = 0$ .
(4) The two parts of the graph are mirror images of each other. The equat of symmetry are y = x and y = -x.	ions of the two mirror lines
	MOCO .
Consider a market of the first of a second s	from complianted or first that after the phontag of tablec and alreading. It because a
reares are former of 1 = "but -5 = 2 = 2 + 5 + 6, and use a colour	And a transfer handler.
(a) the value of y when $x = l.5$	
(a) the value of y when $y = -8$ .	
(a) the value of y when $y = -8$ . (b) the value of x when $y = -8$ .	
(a) the value of y when $x = l.5$ . (b) the value of x when $y \equiv -8$ .	

Figure 4.7 is similar to Figure 4.6, except for two major exceptions. When the Singaporean textbook employs sidebars, they are normally colored and offset from the rest of the content. Also, as seen in Figure 4.7, it is very common to find a lot of white space throughout the pages of the Singaporean textbook. A lot of space is normally found in

between different sections, intended to segregate the information from the earlier section. The usage of white space is highly prominent in the textbook and is used throughout the book except in pages with big graphics, like that found in Figure 4.6.

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#### Chapter 5

#### Discussion

### 5.0 Introduction

This chapter discusses the last two research question of this dissertation:

- ii. How do the stakeholders perceive the differences of the textual contents?
- iii. What are the external factors which influence the perception of readers towards the textbooks and the subject?

The stakeholders in question consist of the students who use the official textbooks and the teachers who teach the subjects. Section 5.1 will discuss the perceptions of the students, while Section 5.2 will discuss the perceptions of the teachers. Section 5.3 discusses all of these perceptions in relation to the findings from Chapter 4.

The names of each participant of this research were not requested in order to keep their identities strictly confidential and to protect them from any possible problems that may arise. Each participant was also given the option whether to state the name of their school or not if they fear they might be identified through their respective schools. The participants were given this option in case they fear that their identities and the information they provide may be misused in any way. Several respondents chose not to name their respective schools for this very reason.

There are two categories of respondents for this survey. The first category of respondents for this research are Malaysian and Singaporean students who have recently finished their respective countries' final secondary level examinations (Sijil Pelajaran Malaysia – SPM for Malaysia and GCE O-Level for Singapore) and are awaiting the results

of the said exams. The Malaysian students are around the age of 18 at the time of the survey. However, there are some students who are younger, as the Malaysian education system allows students to skip a grade twice in the entire flow of education: the first time by choosing to enroll in primary school at the age of 6 instead of 7, and by taking a special test known as *Penilaian Tahap Satu* (Level One Examination) at Standard 3 which allows students to skip Standard 4 and begin at Standard 5 the following year. It also has to be taken into consideration that there may be students who are younger or older, due to circumstances such as financial situations which do not permit schooling at the required age, or health conditions which may cause students to take a year or two off from pursuing their studies.

 Table 5.1: Background details of students from Malaysia who participated in the survey questionnaire. It

 must be noted that only one Malaysian Chinese student was involved in this research, while no Indian

 students were willing to participate in the survey.

Malaysian students						
Participant	Ethnicity	Age	Place of origin	Location of school	Name of school	
1	Malay	18	Johor	Johor	Sekolah Tun Fatimah	
2	Malay	18	Selangor	Selangor	Not provided	
3	Malay	17	Selangor	Selangor	Sekolah Menengah Agama	
					Bestari	
4	Malay	18	Kuala Lumpur	Kelantan	MRSM Pengkalan Chepa	
5	Malay	18	Johor	Johor	Sekolah Tun Fatimah	
6	Malay	18	Selangor	Selangor	SMKA Simpang Lima	
7	Malay	19	Johor	Johor	SMK Kota Masai	
8	Chinese	19	Perak	Perak	Not provided	
9	Malay	18	Negeri Sembilan	Negeri Sembilan	SMK Pendeta Za'ba	
10	Malay	19	Kedah	Pahang	Not provided	
11	Malay	19	Perak	Perak	SMK Kamunting	
12	Malay	19	Kelantan	Kelantan	SMK Dato' Ahmad Maher	
13	Malay	19	Terengganu	Terengganu	SMK Sultan Sulaiman	
14	Malay	18	Kuala Lumpur	Selangor	SMK Section 4 Kota	
					Damansara	
15	Malay	19	Selangor	Selangor	SMK (P) Sri Aman, Petaling	
					Jaya	
16	Malay	18	Kuala Lumpur	Selangor	SMK USJ 4	
17	Malay	19	Johor	Johor	Sekolah Menengah Sains	
					Muar	
18	Malay	18	Terengganu	Kuala Lumpur	Not provided	

19	Malay	17	Selangor	Selangor	Seri Ayesha Islamic School
20	Malay	18	Selangor	Selangor	SMK Seksyen 4 Bandar
					Kinrara
21	Malay	18	Terengganu	Terengganu	Sekolah Menengah Agama
					Nurul Ittifaq
22	Malay	18	Kuala Lumpur	Kuala Lumpur	Darul Hikmah

Table 5.1 shows the background details of all Malaysian students who participated in the survey. The location of their schools is taken into account in order to identify if the students studied in either an urban or rural area. The students come from different states throughout West Malaysia. No students from the states of Perlis, Melaka and Pulau Pinang (which are among the country's smallest states) could be obtained for the survey. No students from East Malaysia were obtainable, for reasons which will be discussed in this chapter. Race was initially taken into consideration in the survey, as racial factors may influence the participants' answers. However, after sampling, it was taken out of consideration due to an imbalance among the races which participated in the survey. All the Malaysian students who participated in this research except one Chinese student were of the Malay race. It is worth noting that no Malaysian Indian students were involved in this research, as all of them refused to participate as they were approached. Therefore, racial factors which may influence the participants' perceptions are not taken into consideration.

Meanwhile, for the Singaporean students, the age of the students are not as consistent as Malaysian students because the various education options in the country have different durations of study, and coupled with external factors such as financial issues and health conditions, it is not easy to determine a "common" age for students to sit for the GCE O Level Examination in the country. In this research, there was a respondent who was as young as 16 years old, while there were also respondents who were in their mid-20s.

 Table 5.2: Background details of students from Singapore who participated in the survey questionnaire.. It

 must be noted that only two Singaporean Chinese students was involved in this research. Similar to the survey

 on Malaysian students, no Indian students were willing to participate in the survey.

Singaporean Students						
Participant	Ethnicity	Age	Place of origin	Location of school	Name of school	
1	Malay	21	Singapore	Singapore	Madrasah Al-Arabiah Al-	
					Islamiah	
2	Malay	19	Singapore	Singapore	Nanyang Polytechnic	
3	Malay	19	Singapore	Singapore	Republic Polytechnic	
4	Chinese	25	Singapore	Singapore	Not provided	
5	Malay	16	Singapore	Singapore	Madrasah Aljunied	
6	Malay	24	Singapore	Singapore	Madrasah Aljunied	
7	Malay	18	Singapore	Singapore	Zhenghua Secondary School	
8	Chinese	18	Singapore	Singapore	Zhenghua Secondary School	
9	Malay	18	Singapore	Singapore	Zhenghua Secondary School	
10	Malay	23	Singapore	Singapore	Madrasah Aljunied	
11	Malay	19	Singapore	Singapore	Zhenghua Secondary School	

Table 5.2 shows the background details of Singaporean students who participated in this survey. As with the previous group of participants, race was initially a factor which was considered in this research. However, as with the case in Malaysia, no Indian students were willing to participate in this research. Curiously, although the Chinese are the majority race and the Malays are the minority race in Singapore, for this particular survey, only 2 out of 11 respondents are Chinese. Therefore, no race-specific issues will be taken into consideration regarding the participants' perceptions.

The second category of respondents consists of Malaysian secondary school mathematics teachers who have taught the subject in English. They were obtained the same way as the students. No Singaporean secondary school teachers were involved in this research, as all the teachers who were contacted refused to take part in the survey.

Table 5.3: Background details of Malaysian secondary school mathematics teachers who participated in the

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bar ve y	question	mane

Participant	Ethnicity	Age	Place of origin	Location of school	Name of school
1	Malay	28	Kedah	Pulau Pinang	SMKTK2

2	Malay	45	Johor	Johor	SMK Tanjung Puteri Resort
3	Malay	31	Kuala Lumpur	Selangor	Integrated Islamic School
					Kota Damansara
4	Malay	24	Kedah	Kedah	Sekolah Menengah
					Kebangsaan Jitra
5	Chinese	40	Sabah	Sabah	Kolej Vokasional Tawau
6	Malay	27	Terengganu	Selangor	SMKRL
7	Malay	47	Negeri Sembilan	Negeri Sembilan	SMK St Paul
8	Malay	26	Perak	Selangor	SMK Damansara Jaya
9	Chinese	N/A	Kuala Lumpur	Kuala Lumpur	SMK Baru Bandar Sentul

Table 5.3 shows the background details of the Malaysian secondary school mathematics teachers who took part in this survey. Yet again, no Indian mathematics teacher from Malaysia was willing to participate. The teachers teach in different states throughout the country. The name of the school which each teacher works at was requested. This is to determine whether the teachers worked in an urban or rural area. The age of the teachers who took part in the survey questionnaire varies, with the youngest being 27 and the oldest being 47. One respondent refused to reveal his age for unknown reasons.

# 5.1 Perceptions of Students towards Textual Contents of Malaysian and Singaporean Mathematics Textbooks

The survey administered to the students consists of three parts: one on demographics; one with questions regarding their perceptions towards elements of metadiscourse, interdiscursivity and semiotics, which make up the linguistic elements of the textual contents; and one section with questions pertaining factors which influence their perceptions, such as the learning environment. Due to the nature of the survey, the discussion of the results will be divided into two parts: one focusing solely on the linguistic elements, and one focusing solely on factors which influence their perceptions. The first subsection, Section 5.1.1 will focus on the former, while the following subsection, Section

5.1.2, will focus on the latter. Data from the demographics will be brought into both parts of the discussion whenever necessary.

### 5.1.1 Perceptions towards Linguistic Elements

Throughout Section B of the survey, the students who took part in this survey were presented with data and questions on the linguistic elements of both Malaysian and Singaporean mathematics textbooks. The first set of questions explored their perception towards metadiscourse markers. The following table shows their perception towards the usage of self-mention metadiscourse markers used in both textbooks.

Table 5.4: Students' perception towards usage of self-mention metadiscourse markers

Country of Origin	Prefers Malaysian textbook	Prefers Singaporean textbook	Prefers both	No preference
Malaysia	7	11	3	1
Singapore	3	5	1	2

Respondents appeared to be divided in their perception towards self-mention metadiscourse makers. Results leaned more towards the Singaporean textbook. A total of 6 respondents remarked that the usage of self-mention metadiscourse marker made the Singaporean book much more preferable because it made them feel more included in the discourse of the textbook. Among their responses are:

"It seems like I'm doing the questions together with them. The first one (Malaysian textbook) asked me to do it alone."

"It shows the author is friendlier."

"Even though it is Mathematics, but we are affected by the choice of words."

"I feel included in the lesson."

"The word 'we' sounds friendlier."

"There is a slight effect. 'We' would be the word I prefer – feels more inclusive."

These statements are in line with Hyland's theoretical framework which highlights self-mention metadiscourse markers as a way to establish connection on a more personal level with readers.

Interesting to note in the data here is that one student mentioned that the selfmention metadiscourse markers were largely unnoticed until the survey question informed them about it. The participant said "I did not even notice the difference until the survey mentioned it". This is possibly due to the nature of the subject, which leans more towards calculations and solving problems rather than language. Thus, language may be a secondary concern to most who study this subject. When asked why they either liked or disliked the textbooks, no remarks were given regarding the Malaysian textbook. However, the Singaporean textbook was said to be "wordy".

Country of Origin	Prefers Malaysian textbook	Prefers Singaporean textbook	Prefers both	No preference
Malaysia	4	13	5	0
Singapore	2	7	1	1

 Table 5.5: Students' perception towards engagement markers

Unlike self-mention metadiscourse markers, when it came to engagement markers, the respondents appeared to be keener towards them. Most respondents preferred the usage of engagement markers found in the Singaporean textbook compared to the Malaysian textbook. The reasons given by most respondents who preferred the Singaporean textbook was that it made the questions and explanations much easier to understand and that it made learning "more manageable". In comparison to self-mention metadiscourse marker, this may suggest that engagement markers are more effective, and that the Singaporean textbook's way of using engagement markers is more engaging. It also raises a few important questions: what metadiscourse marker is most effective in conveying mathematical discourse? How should the markers be used?

 Table 5.6:
 Students' perception towards interdiscursive elements (computer discourse)

Country of Origin	Prefers Malaysian textbook	Prefers Singaporean textbook	Prefers both	No preference
Malaysia	11	7	1	3
Singapore	4	3	0	4

When it came to the usage of interdiscursivity, particularly the incorporation of computer discourse in the mathematics textbooks, opinions appeared to be divided, though more respondents preferred the Malaysian textbook compared to the Singaporean textbook. Those who preferred the Malaysian textbook's usage of computer discourse preferred it due to the "clearer instructions" and usage of graphics found in the book. However, some of the respondents found the computer-based activities accompanying the discourse to be unnecessary, as the students found them to be hard to relate to. A major concern here is relatability. While the incorporation of other discourses does help make a subject more exciting and engaging, if it is not something that students can understand and relate to, ultimately it would fail its purpose in making the subject easier to understand.

Country of Origin	Prefers Malaysian textbook	Prefers Singaporean textbook	Prefers both	No preference
Malaysia	6	14	2	0
Singapore	1	8	1	1

Table 5.7: Students' perception towards interdiscursive elements (transportation discourse)

The results were quite clear as to which textbook was preferred when it came to the usage of transportation discourse. The Singaporean textbook was chosen by both Malaysian and Singaporean students. Many respondents noted that the reason for this choice is because the way it was used in the Singaporean textbook was "easier to understand", "exciting", and "makes points easier to imagine and not boring". This makes a very strong statement. While two books can have the exact same strategy (in this case, the incorporation of transportation discourse), readers may be affected very differently.

 Table 5.8: Students' perception towards interdiscursive elements (boardgame discourse)

Country of Origin	Prefers Malaysian textbook	Prefers Singaporean textbook	Prefers both	No preference
Malaysia	8	8	4	2
Singapore	3	5	0	3

At several instances throughout both the Malaysian and Singaporean textbooks, there was boardgame discourse included. The respondents seem to be mixed about this, and no clear answer can be given regarding which textbook was preferred. However, respondents did note that boardgame discourse is "old-fashioned". This is perhaps the reason for the indifference here – when a discourse is unrelatable, students do not pay attention to it.

Table 5.9: Students' perception towards usage of graphics and sidebars

Country of Origin	Prefers Malaysian textbook	Prefers Singaporean textbook	Prefers both	No preference
Malaysia	6	6	8	2
Singapore	2	3	3	3

Again, a similar attitude can be found here. It is hard to determine what the students actually prefer. However, the students remarked that the usage of graphics and sidebars do help make the subject easier to understand and it also makes the content more engaging.

# 5.1.2 External Factors which Influence Students' Perception towards Textual Elements in Malaysian and Singaporean Mathematics Textbooks

The final part of the survey for the students intended to discover the external factors which influence the perceptions of both Malaysian and Singaporean students towards the textual elements found in Malaysian and Singaporean mathematics textbooks. The students were given complete freedom to answer as much as they wanted, even if that meant not answering at all. All of the students gave a lot of insight, in comparison to the teachers in Section 5.2 who gave minimal feedback.

One thing which all students who took part in the survey unanimously was that the mathematics textbooks could be improved. Interestingly, even though the Singaporean textbook was much preferred by both Malaysian and Singaporean students, almost all Singaporean students felt that their own textbook could be further improved. The Singaporeans wanted their books to be more colorful and have more graphics. A few Singaporean students even said the textbook was dull, despite the fact their book was more colorful and full of graphics compared to the Malaysian textbook. This is an interesting point which deserves attention and raises curiosity. Singapore is a country which ranks highly in mathematics, yet its own students find their textbook to be dull.

There are a few possibilities that can be assumed at this stage. Although the current sample size is small and these opinions from both students and teachers may not truly

represent the practice of all students and teachers in Malaysia and Singapore, the issues raised here do open up the possibility for future research. Perhaps the textbooks of other subjects taught in Singapore are more exciting and more colorful. It is also possible that the teaching strategies used by the teachers are the main source of knowledge for students rather than the textbooks. Further feedback from Singaporean students confirms this, as they said that what their teachers had taught in class was enough and that they didn't really use the textbooks in class. There are many factors which can come into consideration, but regardless of the factors, the combination of factors – textbook, teaching strategies, and learning environment – all play a role in the quality of mathematics education in a country.

Similarly, most Malaysian students said that the teachers did not use the textbooks in class, but that what the teachers taught them is "enough". The definition of "enough" here is different from Singapore's, as reflected in Malaysia's performance in the subject. This raises a few questions: What is the value of education for students? What makes a student know that he or she has learned enough? What factors could lead to students not wanting to learn? Education is supposed to prepare students as much as possible for both their own personal needs and for entering the job market. Education should not discourage students to not be their best. Again, this shows that there are many factors which need to be considered when gauging the effectiveness of mathematics education in a country.

Another sentiment which both Malaysian and Singaporean students shared was that they felt extra materials and reference books were necessary. This actually contradicts what the students themselves said, that what the teachers taught was "enough". Perhaps "enough" in a classroom context is different from "enough" for an exam or self-study context. An important question is raised here. An official textbook is supposed to be the main source of information, as it is sanctioned by the government, and the national examinations are based on the textbook. When students feel that the textbooks are not essential, this implies that what the government and schools have provided is not important for examination purposes. Are the examinations and syllabus designed by the same people? Are they following the same blueprint? If they are, then such an issue should not exist, but the students' sentiment here seems to point otherwise.

# 5.2 Perceptions of Malaysian Teachers towards Textual Content of Malaysian Mathematics Textbooks, Malaysian Students and the Education System

The other part of the stakeholders consists of secondary school mathematics teachers. As this dissertation looks at how the Malaysian mathematics textbook could be improved with the Singaporean textbook only a benchmark, only Malaysian teachers are included in the survey.

# 1. What do you feel about teaching mathematics in English? What was the experience like? What difficulties did you face?

The teachers were first asked what they felt about teaching mathematics in English. All respondents had positive feedback, stating that it was "fun", "interesting" and a "good experience". However, five of the nine respondents added that it was a challenge to teach mathematics in English when the students were not proficient in the language. Respondent #5 remarked that in order to counter this, there was a need to translate English terms into Malay. Respondent #6 noted that the terms were a challenge.

# 2. How important is the textbook in teaching mathematics? Do you use the textbook when teaching? Why?

When the teachers were asked about the importance and role of the textbook in the classroom, respondents suggested that the textbook was not effective. The textbook was simply used as a reference, but not the primary teaching material. Questions from the textbook were not used – the teachers preferred to use either their own questions or questions from other reference books. Respondent #2 noted that the questions in the book do not at all reflect the kind of questions in the exam. The fact that these teachers do not rely on the textbook brings up concern and questions regarding the actual effectiveness of the strategies used in formulating the questions in the textbook.

3. What do you feel about the language, layout and contents of the textbook and the syllabus? Some parts of the book uses highly technical language, some parts use "we" often, while some parts feature repetitive instructions? How should it be improved? Regarding the language used in the textbooks, the response was similarly negative. Five respondents felt the language of the textbooks could be improved. However, no reason was given regarding why they felt that way and if the language had to be improved. The teachers did remark that the layout of the textbook needs to be improved, but did not elaborate how it should be done.

4. A previous survey we've done showed that students find some of the contents of the textbooks boring and outdated, as it mentions events and materials which are hard for them to relate to. What do you feel about this? How should this be improved?

The teachers were then presented with data from the previous survey – the feelings and perceptions of Malaysian and Singaporean students regarding the language used in the textbooks. They were told that the students found the contents to be dull and outdated, and were asked how they felt about this and how can the situation be improved. The teachers were asked about how they feel about the students' response to the textbooks. The teachers' responses were interesting – one teacher answered "yes" and another teacher answered "no", despite the fact there was no yes/no question being asked. One teacher remarked that students could not relate to the contents of the textbook because the textbook was "old". Respondent #8 suggested that younger writers should write mathematics textbooks, believing that older writers are not able to connect with the younger generation.

# 5. In your opinion, what can be done to make the textbooks more exciting and engaging for use in class?

When asked how to make the textbooks more exciting and engaging, all respondents suggested the usage of teaching aids such as presentation slides and multimedia. This is interesting to note, as these are all materials which are not in the textbook, but outside. Two teachers suggested that the textbooks should have more examples and should be more colorful.

6. The mathematics textbooks often refer to the outside world (e.g. sports, media, electronics, etc). What do you feel about this? Does this help make mathematics more interesting? Why?

The teachers also had a unanimous response regarding the usage of interdiscursivity in the textbooks. They felt that it helps students understand mathematics better. Three respondents felt that the usage of interdiscursivity could be improved further, and one suggested the usage of more graphics and cartoon characters in engaging with students.

# 7. Do you use any additional textbooks/reference books/exercise books when teaching mathematics? How are they useful in your classes? Why?

It was found that all of the respondents admitted to using additional books and references in addition to the official textbook provided. The reason, as highlighted by one of the respondents, was that the official textbook was simply "not enough". This brings about concern regarding the quality, practicality and actual usefulness of official textbooks. The official textbooks are made to be the prime source of information for students and teachers which meet the requirement of the syllabus as highlighted by the ministry of education of the country the books are published in. However, the claim that the even the textbook are not enough raises questions as to whether the textbooks actually fulfill what is required in the syllabus or not.

8. What about the learning environment/system can be improved in order to make learning and teaching mathematics more exciting and engaging for both teachers and students? Why?

The respondents were then asked about the learning environment in school and how conducive it is in mathematics education, none of the respondents gave a clear answer. One teacher mentioned that the environment needs to be more suitable, but did not define what kind of environment was being referred to. Some of the respondents appeared to lament about the situation. The teachers claimed that using technology in the classroom a challenge for them due to the learning curve. They noted that their students felt technology is more exciting compared to traditional mathematics. This also raises another concern. Mathematics is an important knowledge that leads to the development of technology, and much of the technology used today by students today would not be possible if it weren't for algorithms derived from mathematics. One teacher noted that the students would only find mathematics interesting if it is relatable to the technology they were interested in. Ironically, this respondent failed to see how technology and mathematics are closely connected. This is because today's technological advances would be impossible without mathematics. If teachers were willing to learn more about technology and make the connection between it and mathematics, this could help make mathematics classes more exciting and engaging. An investigation into the discourses and attitudes of teachers and students regarding the relevance of mathematics could shed further light on this.

# 9. Does the government/your school provide any additional materials/guidelines to assist you in the teaching of mathematics? Are they useful? Why?

The respondents were also asked whether the government has provided any form of assistance for their teaching and whether or not it is useful. They did indeed receive assistance except for one of the respondents who teaches at a private school. However, not all respondents described the helpfulness of the materials provided. Respondent #2 highlighted that the teaching aids such as laptops and LCDs were actually taken back after PPSMI was announced to be abolished. This raises a major question. Mathematics is a subject that is more or less the same, regardless of what language is used as the medium of

instruction. Aids such as laptops and LCDs are not affected by language. Thus, it is a curiosity that they were taken back. Respondent #5 noted that the teaching aids are only useful if students actually used it, which brings about another curiosity. It is the teacher's role to spark interest among the students. Further investigation could lead to answers regarding this.

### 10. How do you normally teach mathematics to your students? Briefly describe.

Next, the respondents were asked how they taught in class. This is meant to discover the discourse used in the classroom. However, the answers given were very short and did not reflect much on what they actually taught in class. What all the answers shared in common was that their teaching methods involved explanations, though no elaboration on this explanation method is given.

# 11. Do you have any additional comments/remarks regarding secondary school mathematics education? If yes, what are they?

Finally, the respondents were asked if they had any final comments, three interesting comments which deserve discussion were given. Respondent #2 preferred that the textbooks followed the SPM examination format. This is a point of curiosity, as the textbooks are written according to the government's syllabus specifications. However, such a remark would mean that the books do not precisely follow the said syllabus if it were to be different from the SPM format. Respondent #3 and respondent #9 wanted mathematics to remain in English, while respondent #6 mentioned there were too many topics to be covered in the syllabus.

### 5.3 Potential Reasons behind Stakeholders' Perceptions

Through the discussion so far, a number of questions have been raised regarding the contents of the mathematics textbooks and mathematics education in general. It appeared that there is some form of conflict in many areas of mathematics education which need to be addressed. One of the most important issues which need a solution is the effectiveness and relevance of mathematics textbooks. Before the surveys were carried out, it was assumed that this was much needed in Malaysia, due to the fall in rankings and decrease in students' performance. However, after the survey done, it became clear that this issue also applies to Singapore. Students from both countries as well as Malaysian teachers found that their textbooks were not enough. As mentioned earlier in this chapter, the definition of what is "enough" is definitely subjective, but the fact that this sentiment is shared by all deserves attention.

There are several possible reasons as to why the textbooks are not "enough". In today's era, books are becoming less read and less relevant for many from the young generation. More and more youths are becoming increasingly socialized with technological gadgets and social media. Youths are keener to refer to the internet for instant gratification in obtaining information. The authors of official textbooks could put more effort into crafting an experience rather than simply inserting an entire syllabus into the book. Not much information was able to be obtained from the authors, as the publishers of both the Malaysian and Singaporean textbooks did not respond to any calls or emails.

Another possible reason is the usage of textbooks itself. As noted by students and even some of the teachers, the textbook was actually not used much in the classroom. For students, when the textbook is not used by the teachers, they would not feel that it is important. The fact that teachers themselves admit to not using the textbooks is a big point of curiosity, because as teachers serving in government schools, it is part of their job requirement to use the textbook. This does raise the issue of the quality of teachers in Malaysia as well as the effectiveness of their teaching methods. As of late, there are many unresolved issues regarding the quality of education in Malaysia. If this issue goes unnoticed, the textbook could go obsolete in mathematics education.

An interesting point was that this incident is also happening in Singapore, and Singapore is doing much better than Malaysia in terms of education. This goes to show that the textbook is not the only main factor behind the effectiveness of education. It is likely that other factors such as the learning environment and the in-class discourse used by teachers with their students could have influenced students' interest and performance in the subject. While the textbook is intended to be the primary source of information for students and teachers, it is not the only source for them. Otherwise, there would be no point to have schools in the first place. The classroom discourse would thus be just as important as the textbook.

This is where another valid point is raised. Textbooks with the best metadiscourse strategies can be written and developed, but are these strategies also used by teachers in their classroom discourse? Have teachers been sufficiently trained to teach the subject? In the survey for this dissertation, teachers themselves found certain parts of the subject hard to relate to and found some parts uninteresting. Also, the responses from the teachers were much shorter than the responses from the students. Teachers are supposed to not only teach students but also be beacons of inspiration for students. If the attitude of teachers towards the subject and students are not up to the standard, then it would be impossible to expect students to be up to the standard.

Regarding the linguistic elements found in the Malaysian and Singaporean mathematics textbooks, even though there are differences, the similarities are many indeed. Both books employ similar metadiscourse strategies. However, it must be noted that the effectiveness is largely dependent on how accustomed the students are with such language. The level of English in Singapore is much higher. In fact, English is the official language in Singapore, thus English is not alien to the people there. However, in Malaysia, despite being a former British colony, English is still difficult for many students and teachers alike, especially in the rural areas, though there are many cases of students and teachers being weak in English in the urban areas as well. This means that the books could be written extremely well, but if the audience does not understand the language used, the books would be useless.

The most important factor that needs to be considered in a discussion of textbook discourse is related to the psychology of learning. What is the general attitude of students and teachers towards the subject? How do they perceive the language? What does it make them feel? Do they genuinely feel excited to study the subject? As far as this dissertation's findings are concerned, there does not appear to be much attempt to do this from all quarters, be it the textbook, teachers or students. The findings of this dissertation are significant, as a number of problems have been uncovered. These problems require more research in the future, which will be discussed in the next chapter.

#### **Chapter 6**

#### Conclusion

#### 6.0 Summary

The following section (Section 6.1) provides recommendations to the problems presented in this dissertation, while the final section (Section 6.2) discusses the problems and limitation of the current study, as well as possible directions for future research.

### 6.1 Recommendations to the Problem Statements

The purpose of this section is to propose a number of suggestions and recommendations to the problems which were uncovered throughout the discussion of this dissertation.

i. Research should be done on how to tackle issues, rather than introduce new changes

As highlighted in the introduction of this research, the Malaysian education system has gone through many changes. The Malaysian mathematics textbooks used in schools also change every time the education system changes. However, these changes were introduced without analysis on why previous textbooks have failed and why the same problems still plague the syllabus used today (Musa, 2003). Such changes do not necessarily change the quality of the education. Most changes were done without feedback from stakeholders. Solutions to the problem could be found if all relevant feedback from the stakeholders were considered.
## ii. Teachers should explore new approaches in teaching

In the discussion section of this dissertation, it was discovered that a number of students and teachers found the subject to be dull, and some found it hard to relate to. Students today find it hard to accept what is written in textbooks, as the students are becoming more socialized with social media and digital gadgetry rather than with people (Prensky, 2002). The textbooks in this dissertation have been shown to use interdiscursivity to refer to possible activities in class, and this concept could be further explored in actual practice.

## iii. Experiment with different writing styles for mathematics textbooks

It was also discovered that the textbook's content was perceived as technical, difficult and dry. Students today prefer social media and games. Writers who are more in touch with this reality could perhaps write a more exciting textbook for students to read. Findings from this dissertation that students found the usage of discourse in the textbooks to be dull and boring. More research on effectively using metadiscourse could be done to engage the readers and make them feel more excited about the subject.

## 6.2 **Recommendations to Future Research**

This research at present has a number of limitations. Only final secondary level mathematics textbooks were used in this study, and it was difficult to obtain in-depth feedback from the respondents, due to the nature of online questionnaires. Future research can consider looking into textbooks from other grades, as well as workbooks and supplementary materials, all of which are part of the materials used for each country's

national level examinations. More insight can also be obtained by obtaining in-depth views from students, teachers, parents, policy makers and the writers of the textbooks and learning materials, in order to triangulate and expand upon the findings of this research.

## References

- Ali, M. R., Yong, K.Y., Ahmad, S., Kusnin, M., Bashah, S.Z.M. (2008). *Mathematics Form 5*. Semenyih: Awan Metro.
- Alshwaikh, J., Morgan, C. (2013, June). Analyzing the Palestinian School Mathematics Textbooks: A Multimodal (Multisemiotic Perspective). Proceedings of the British Society for Research into Learning Mathematics 33(2).
- As Singapore Tops World, Malaysia Ranks Low on Latest OECD Maths and Science Scores. (May 13 2015). *The Malay Mail*. Retrieved from http://www.themalaymailonline.com/malaysia/article/as-singapore-tops-worldmalaysia-ranks-low-on-latest-oecd-maths-and-science#sthash.8OU9xDX1.dpuf
- Asia University Rankings 2013 Top 100 Times Higher Education. Retrieved from http://www.timeshighereducation.co.uk/world-university-rankings/2012-13/regional-ranking/region/asia
- Atnafu, M. (2014). Secondary School Mathematics Teachers' Attitude in Teaching Mathematics. *Mathematics Education*, 9(1), 57-72.
- Babbie, E. R. (2004). *The Practice of Social Research*. Belmont, CA: Thomson/Wadsworth.
- Bamford, J. (2004). Gestural and Symbolic Uses of the Deictic Here in Academic Lectures. In K. Aijmer, Stenstrom, A. (Ed.), *Discourse Patternsin Spoken and Written Corpora* (Vol. 120, pp. 113-138). Amsterdam: John Benjamins.
- Bechhofer, F., Paterson, L. (2000). Principles of Research Design in the Social Sciences. London: Routledge.
- Bhatia, V. K. (2003). Applied Genre Analysis: A Multi-Perspective Model. *Iberica*, 4, 3-19.
- Brutal truths of education system. (2012, July 30 2012). *The Star*. Retrieved from http://www.thestar.com.my/story/?file=%2f2012%2f7%2f30%2ffocus%2f1175562 2&sec=focus
- Crismore, A. (1989). *Talking with Readers: Metadiscourse as Rhetorical Act*. New York: Peter Lang.
- Crismore, A. (1990). Metadiscourse and discourse processes: interactions and issues. *Discourse Processes 13*, pp. 191-205.
- Camiciottoli, B. C. (2003). Metadiscourse and ESP Reading Comprehension: An Exploratory Study. *Reading in a Foreign Language*, 15(1).
- Chen, K. S. (2013, December 5 2013). Malaysia Ranks 52 out of 65 Countries in

International Assessment Programme. *The Star.* Retrieved from http://www.thestar.com.my/News/Nation/2013/12/05/Students-score-below-global-average-Malaysia-ranks-52-out-of-65-countries-in-international-assessmen.aspx/

- Chen, K. S. (2013, December 8 2013). Poor Show in Pisa Rankings. *The Star*. Retrieved from http://www.thestar.com.my/news/education/2013/12/08/poor-show-in-pisa-rankings/
- Collopy, R. (2003, January). Curriculum Materials as a Professional Development Tool: How a Mathematics Textbook Affected Two Teachers' Learning. *The Elementary School Journal*, 103(3), 287-311.
- Cooper, H. (2010). Research Synthesis and Meta-analysis. London: Sage Publications.
- Creswell, J. W., Clark, V.L.P. (2007). Designing and Conducting Mixed Methods Research. London: Sage.
- Creswell, J. W. (2014). Research Design: Qualitative, Quantitative and Mixed Methods Approach. London: Sage.
- Crossley, S. (2007). A Chronotopic Approach to Genre Analysis: An Exploratory Study. *English for Specific Purposes*, 26(1), 4-24.
- Ding, H. (2007). Genre Analysis of Personal Statements: Analysis of Moves in Application Essays to Medical and Dental Schools. *English for Specific Purposes*, 26(3), 268-392.
- Dixon, L. Q. (2005). Bilingual Education Policy in Singapore: An Analysis of Its Sociohistorical Roots and Current Academic Outcomes. *International Journal of Bilingual Education and Bilingualism*, 8(1).
- Dixon, L. Q. (2005). The Bilingual Education Policy in Singapore: Implications for Second Language Acquisition Proceedings of the 4th International Symposium on Bilingualism (J. Cohen, McAlister, K.T., Rolstad, K., MacSwan, J. Ed.). Massachussets: Cascadilla Press.

Education in Singapore. (1972). Singapore: Educational Publications Bureau.

Fairclough, N. (1995). Critical Discourse Analysis. London: Longman.

- Fairclough, N. (2003). Analyzing Discourse: Textual Analysis for Social Research. London: Routledge.
- Gee, J.P. (1999). An Introduction to Discourse Analysis: Theory and Method. London: Routledge.
- Gopinathan, S. (2007). Education and Development in Singapore. In J. Tan, Gopinathan, S., Ho, W.K. (Ed.), *Education in Singapore: A Book of Readings*. Singapore:

Prentice Hall.

- Herbel-Eisenmann, B., Wagner, D. (2005). *In the Middle of Nowhere: How a Textbook Can Position the Mathematics Learner.* Paper presented at the 29th Conference of the International Group for the Psychology of Mathematics Education.
- Hossain, M. A., Tarmizi, R.A., Ayub, A.F.M. (2012). Collaborative and Cooperative Learning in Malaysian Mathematics Education. *Indo MS-JME*, *3*(2), 103-114.
- Hussin, S. (2004). *Pendidikan di Malaysia: Sejarah, Sistem dan Falsafah*. Kuala Lumpur: Dewan Bahasa dan Pustaka.
- Hyland, K. (1998). *Hedging in Scientific Research Articles*. Amsterdam: John Benjamins.
- Hyland, K. (1998). Persuasion and Context: The Pragmatics of Academic Metadiscourse. Journal of Pragmatics, 30, 437-455.
- Hyland, K. (2004). Disciplinary Interactions: Metadiscourse in L2 Postgraduate Writing. Journal of Second Language Writing, 13(2), 133-151.
- Hyland, K., Tse, P. (2004). Metadiscourse in Academic Writing: A Reappraisal. *Applied Linguistics*, 25(2), 156-177.
- Hyland, K. (2005). Metadiscourse. New York: Continuum.
- Hyland, K. (2012). Disciplinary Identities: Individuality and Community in Academic Discourse. Cambridge: Cambridge University Press.
- Idris Jusoh: Malaysia's Higher Education System World Class. (2015, February 21 ). *The Star.* Retrieved from http://www.thestar.com.my/news/nation/2015/02/21/education-malaysia-worldclass-idris-jusoh/
- Jiang, C. (2015). Singapore 1st, Malaysia 52nd in Global School Ranking. Retrieved from http://www.theantdaily.com/Main/Singapore-1st-Malaysia-52nd-in-global-schoolranking#sthash.hHh4w0KZ.dpuf
- Kaur, B. (2014). Mathematics Education in Singapore: An Insider's Perspective. *Indo MS-JME*, 5(1), 1-16.
- Kopple, W. J. V. (1985). Some Exploratory Discourse on Metadiscourse. *College Composition and Communication*, 36(1), 82-93.
- Kress, G., van Leeuwen, T. (1996). *Reading Images: The Grammar of Visual Design*. London: Routledge.
- Kress, G., van Leeuwen, T. (2001). *Reading Images: The Grammar of Visual Design*. London: Routledge.

- Kress, G. (2010). *Multimodality: A Social Semiotic Approach to Contemporary Communication*. London: Routledge.
- Kristeva, J. (1980). Desire in Language: A Semiotic Approach to Literature and Art. Oxforf: Blackwell.
- Kumpf, E. P. (2000). Visual Metadiscourse: Designing the Considerate Text. *Technical Communication Quarterly*, 9, 401-424.
- Lai, F. Y., Ishak, M.S.A. (2012). Framing Controversy over Language Policy in Malaysia: The Coverage of PPSMI Reversal (Teaching of Mathematics and Science in English) by Malaysian Newspapers. Asian Journal of Communcation, 22(5), 449-473.
- Lev-Zamir, H., Leikin, R. (2011). Creative Mathematics in the Eye of the Beholder: Focusing on Teacher's Conception. *Research in Mathematics Education*, 13(1), 17-32.
- Lev-Zamir, H., Leikin, R. (2011). Declining Participation in Post-compulsory Secondary School Mathematics: Students' Views of and Solutions to the Problem. *Research in Mathematics Education*, 13(3), 269-285.
- Lewis, G. (2013). Emotion and Disaffection with School Mathematics. *Research in Mathematics Education*, 15(1), 70-86.
- Loong, E. Y. (2014). Using the Internet in High School Mathematics. *Indo MS-JME*, 5(2), 108-126.
- Luzon, M. J. (2005). Genre Analysis in Technical Communication. *IEEE Transactions on Professional Communication*, 48(3).
- Malaysia Capable Improving Its Position in PISA 2015. (2013). Retrieved from http://english.astroawani.com/malaysia-news/malaysia-capable-improving-itsposition-pisa-2015-26809
- Matic, L. J. (2014). Mathematical Knowledge of Non-mathematics Students and Their Beliefs about Mathematics. *Mathematics Education*, 9(1), 13-24.
- Mauranen, A. (2004). They're a Little Bit Different. In K. Aijmer, Stenstrom, A. (Ed.), *Discourse Patternsin Spoken and Written Corpora* (Vol. 120). Amsterdam: John Benjamins.
- McLeman, L. (2012). Prosepctive Teachers' Conceptions about Language and Mathematics Regarding English Language Learners. *International Electronic Journal of Mathematics Education*, 7(1).
- Mey, J. L. (2005). Discourse and Metadiscourse. Journal of Pragmatics, 37(9), 1323-1324.

Mok, S. S. (1996). Pendidikan di Malaysia. Kuala Lumpur: Kumpulan Budiman.

- Morgan, C. (2006). What Does Social Semiotics Have to Offer Mathematics Education Research? *Educational Studies in Mathematics*, 61(1/2), 219-245.
- Mullis, I. V. S. M., M.O, Foy, P., Arora, A. (2012). Trends in International Matematics and Science Study (TIMSS) 2011 International Results in Mathematics. Retrieved from http://timssandpirls.bc.edu/timss2011/downloads/T11\_IR\_Mathematics\_FullBook.p df
- Musa, M. B. (2003). An Education System Worthy of Malaysia. Petaling Jaya: Strategic Information Research Development.
- Now it's Maximum of 12 Subjects for SPM Students. (2013). *The Star*. Retrieved from http://www.thestar.com.my/News/Nation/2013/03/14/Now-its-maximum-of-12-subjects-for-SPM-students/
- O'Keefe, L., O'Donoghue, J. (2014). A Role for Language Analysis in Mathematics Textbook Analysis. *International Journal of Science and Mathematics Education*, 13(3), 605-630.
- Olsen, W. (2012). Data Collection, Key Debates and Methods in Social Research. London: Sage.
- Pakir, A. (2007). Education and Invisible Language Planning: The Case of English in Singapoore. In J. Tan, Gopinathan, S., Ho, W.K. (Ed.), *Education in Singapore: A Book of Readings*. Singapore: Prentice Hall.
- PISA: Malaysia up in maths, down in science and reading. (2013, December 13). *The Malay Mail.* Retrieved from http://www.themalaymailonline.com/malaysia/article/pisa-malaysia-up-in-mathsdown-in-science-and-reading
- *QS University Rankings: Asia 2014 | Top Universities.* (2014). Retrieved from http://www.topuniversities.com/university-rankings/asian-university-rankings/2014#sorting=rank+region=+country=+faculty=+stars=false+search=
- Rashid, N. A., Lee, K.C., Mahayudin, Z., Noordin, Z. (2012). *Falsafah dan Pendidikan di Malaysia*. Shah Alam: Oxford Fajar.
- Remillard, J.T. (2000, March). Can Curriculum Materials Support Teachers' Learning? Two Fourth-Grade Teachers' Use of a New Mathematics Text. *The Elementary School Journal*, 100(4), 331-350.

Richards, L. (2005). Handling Qualitative Data: A Practical Guide. London: Sage.

Saadati, F., Tarmizi, R.A., Ayub, A.F.M. (2014). Utilization of Information and

Communication Technologies in Mathematics Learning. Indo MS-JME, 5(2), 138-147.

- Samson, C. (2004). Interaction in Written Economic Lectures. In K. Aijmer, Stenstrom, A. (Ed.), Discourse Patternsin Spoken and Written Corpora (Vol. 120). Amsterdam: John Benjamins.
- Schiffrin, D. (1980). Metatalk: Organizational and Evaluative Brackets in Discourse. Sociological Inquiry. *Language and Social Interaction*, 50, 199-236
- Scollon, R., Scollon, S.W. (2003). *Discourses in Place: Language in the Material World*. London: Routledge.
- Sinclair, J. (2004). Trust the Text: Language, Corpus and Discourse. London: Routledge.
- Soon, T. W. (1988). *Singapore's New Education System*. Singapore: Institute of Southeast Asian Studies.
- SPM Results Don't Tell the Real Story. (2014). Retrieved from http://www.malaysiachronicle.com/index.php?option=com\_k2&view=item&id=248741:spm-resultsdont-tell-the-real-story-nurul&Itemid=2#axz2y76u1ANb
- Swales, J. (1990). *Genre Analysis: English in Academic and Research Settings*. Cambridge: Cambridge University Press.
- Tan, C. T. (2007). Policy Developments in Pre-School Education in Singapore: A Focus on Key Reforms in Kindergarten Education. *International Journal of Child Care and Education Policy*, 1(1), 35-43.
- Teh, K. S., Loh, C.Y., Yeo, J., Chow, I. (2012). Mathematics 4. Singapore: Shinglee.
- Thimm, V. (2013). Education, Migration Gender: Policies of Education in Malaysia and Singapore. *GSE Journal of Education*.
- Toumi, N. A. (2009). A Model for the Investigation of Reflexive Metadiscourse in Research Articles. In L. J. O'Brien, Giannoni, D.S. (Ed.), *Language Studies Working Papers* (Vol. 1, pp. 64-73). Reading: University of Reading Press.

van Leeuwen, T., Jewitt, C. (2001). The Handbook of Visual Analysis. London: Sage.

- Wahab, A. (2015). World Class Education? Malaysia Ranked 52nd Again in Global Education Ratings. Retrieved from http://www.malaysiandigest.com/news/553456-world-class-education-malaysiaranked-52nd-again-in-global-education-ratings.html
- White, J.W., Lowenthal, P. (2011). Minority College Students and Tacit "Codes of Power": Developing Academic Discourses and Identities. *The Review of Higher Education*, 34(2), 283-318.

- *Why choose IGCSE/International GCSE/GCE O Levels?* (2014). Retrieved from http://www.britishcouncil.my/exam/igcse-school/choose/why-igcses
- Williams, J.M. (1981). Style: Ten Lessons in Clarity and Grace. Glenview, IL: Scott, Foresman.